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# **An organological basis for the development of keyboard technique from the sixteenth to the eighteenth centuries**

**With an emphasis on  
Johann Sebastian Bach**

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A thesis submitted in fulfilment of the requirements for the award  
of the degree of Doctor of Philosophy

The University of Edinburgh

2015

# Abstract

## Organological basis for the development of keyboard technique from the sixteenth to the eighteenth centuries

Historical keyboard instruments have for many years been a valuable source of information regarding historical building techniques and performance practices. However, almost no attention has been paid to the evidence of wear present on these instruments. This physical trace documents the form in which an instrument has been used throughout time. Of particular interest is the evidence of wear found on the surface of the keys. An analysis of this physical trace might provide insight into a number of aspects which have defined the manner in which performers have approached their instruments.

A survey of historical keyboard playing practices will help to visualise in a broader form the mechanical reasons behind the impact of the fingers on the surface of the key. However, it is important to consider that while the process behind the appearance of a trace of wear is primarily of a mechanical nature, the fact that both instrument and the performer's body are cultural objects calls for an examination of a number of issues which seem to influence the form in which the mechanical action is applied.

Two important routes are thus taken in this study before the trace of wear is examined. First, a number of uses of the hand and the fingers seem to have originated in the interaction between the performer and the earliest keyboard designs that the medieval organ displayed. An analysis of these uses served as a starting point for the study here of a number of playing practices which remained in currency for long periods. Second, the forms in which the instrument is built and the body operates at it are the result of the socio-cultural and historico-geographical conditions in which both are submerged. Particular attention is thus given here to the potential effect the performer's socio-cultural background had on the mechanical action he or she was to use when performing.

An experimental clavichord, whose tops were designed to reveal patterns of abrasion more rapidly than those commonly used to cover the keys, was used to aid in an examination of the particular effect of the fingers on the surface of the key. In this form, specific information concerning the various stages of the abrasion caused by the finger's contact with the surface of the keys could be gathered. The worn keys of this instrument also provided a much needed reference point to which historical traces of wear could be compared. This helped to establish a number of potential finger actions that might have been responsible for the traces of wear on some historical instruments.

A reconstruction of J.S. Bach's playing approach was adopted for playing on the experimental clavichord. At the same time, a number of socio-cultural aspects which might have defined Bach's approach to the instrument were explored. In this form, a broader picture could be offered which is not limited to an understanding of the most likely mechanical causes behind the origin of the trace of wear.

# Declaration

I hereby certify that this thesis is my own unaided work. Any ideas expressed in it, unless specifically and duly acknowledged to come from the work of others, are my own.

I also declare that the material here included has not been submitted previously for any other degree or professional qualification.

[Erasmó Estrada]

Edinburgh, January 31, 2015



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# Introduction

If you want to understand the invisible, look carefully at the visible

*The Talmud*

The idea behind this dissertation began to form in my head while a fortepiano undergraduate student in Amsterdam. At that time, I had the opportunity to play regularly on historical instruments. It was also around this time that I was obliged to stop playing for six months as a result of a bicycle accident in which I injured my right wrist. As a consequence of this my wrist became biomechanically unstable. For this reason, I had afterwards to search for a playing approach which would allow me to perform in a comfortable manner. It was during my exploration of all imaginable sorts of hand and wrist positions that I came to realise the subtle effects of these variations on the mobility of the fingers. At the same time, I gradually became aware of their possible relation to the wear present in the keys of a number of fortepianos. Subsequent visits to instrument collections around Europe allowed me to further observe and compare the traces of wear that early performers had left on the surface of the keys of historical keyboard instruments.

After having examined a considerable number of instruments it became clear that in some instances distinct wear patterns could be recognised. This situation suggested that mechanical differences among the ways in which performers approached the key might have existed. An immediate conclusion was that these differences could be identified by examining the mechanical implications of the various approaches found in historical treatises, accounts of the playing of a number of performers, and iconography. Thus, the idea emerged that a correlation between the physical trace of wear on the surface of the keys and a movement produced by the body of the performer could be found.

It soon became clear, however, that though the patterns of wear are mechanically produced, this physical evidence cannot be approached from a purely mechanical point of view. This comes about because both the movements behind the production

of the physical trace of wear and the instrument where this is found are products of unique human bodies which are at all times shaped by the social and cultural conditions in which people live. Thus, an attempt to study the evidence of wear needs to consider 1) the reasons behind both the mechanical origin of the physical trace and, 2) the socio-cultural shaping of the body producing the movement necessary in performance. For this reason, before the potential information that a study of the trace of wear might deliver is discussed here, it will be necessary to briefly examine these two aspects which, I will argue, define the relation between the performer and the instrument.

The physical action necessary to handle a musical instrument depends on the particular building characteristics of the instrument itself. On the other hand, how the performer accomplishes this physical action depends on the biomechanical characteristics of the human body. The relation between these two components gives origin to what I will refer in this work as the *physico-mechanical* approach to the instrument. Let me illustrate this relation with a simple example. The key of a harpsichord needs to be pressed down in order that the quill sets the string in motion. Thus, the player has to find a bodily (physical) movement which would help to fulfil the instrument's (mechanical) requirement.

The pressing of the key can be done through the use of one finger or the fist, the elbow or the nose. The use of the finger approach is self-evident in hindsight. However, a re-evaluation of a number of aspects of the history of the organ's keyboard shows that in keyed instruments of the Middle Ages the fingers were used in a distinctly different manner than in later historical periods. Here, I will argue that while the earliest approaches to the organ were derived from a consideration of the characteristics of its keyboard design, the movements used to press down the keys were the body's most natural, that is to say, those inherent to the biomechanical characteristics of the arm, hand, and fingers. Further exploration of the keyboard medium was to contribute to a development of distinctive keyboard idioms. Yet, the mechanical approaches necessary to perform these seem to have remained largely based on those developed during the exploration of some of the earliest keyboard designs. This situation suggests that while the necessities arising from particular

performance requirements of individual keyboard idioms and musical styles called for differentiation and nuance in the performer's approach to the instrument, these last were greatly indebted to the way in which the socio-cultural sphere, to which music, instrument, performer and listener belonged, shaped the body.

The relationship between the player and the instrument is a complex one. As we have seen, in instrumental performance this is not limited to a physico-mechanical interaction, namely, one which solely takes into account the mechanical characteristics of the performer's body and the instrument. This relation is also determined by the condition of both body and instrument as cultural objects.

The instrument is a cultural object which is devised, built, and played by a socio-culturally shaped body. It is thus the result of a given socio-cultural reality. On the other hand, the trace of wear is the result of the unique mechanical action originating from the socio-culturally shaped body of the performer. While the motivation behind the movement necessary to play the key can go from the merely functional (e.g. to press down the key in order to give the pitch to the choir), to the deeply-held belief (e.g. to play a melody that would move listeners into devotion), it is still imbued with cultural significance. Although this motivation can perhaps not be grasped through an analysis of the trace of wear, it, nonetheless, existed. For this reason, in this thesis I will refer to the set of mechanical movements used in keyboard performance—i.e. those in which the arm, hand, and fingers take part—which is considered to have been shaped by elements of the performer's socio-cultural sphere as a *techno-mechanical* approach to the instrument. On the other hand, the term *bodily attitude* will refer to the overall physical activity at the instrument of the socio-cultural shaped body of the performer.

As will become clear in the following chapters, the path to understanding the trace of wear on the surface of historical keyboard instruments is through an examination of these issues. Otherwise, there is a risk that a mechanical assessment of this trace prevails, something which, I suggest, will limit its value within performance studies. For reasons of time and space a thorough study of the impact of the socio-culturally shaped body of the performer on the production of the trace of wear could not be included here. An extended analysis of this cultural object in relation to wear will

need to be attempted in another place. Yet, though the instrument is at the centre of the considerations of this work, and in order to avoid leaving a large vacuum, in chapters 4 and 5 I will briefly examine the implications of socio-culturally shaped movement. This examination, however, has again the instrument as its main object of analysis.

## The evidence of wear

Although there are some scattered references to the presence and possible origin of traces of wear on historical keyboard instruments, the study of this physical evidence, so far as I am aware, has not been attempted systematically before. However, at least two authors have related the traces of wear of particular instruments to specific playing practices.

Based on an inspection of a number of historical Portuguese clavichords Gerhard Doderer suggested that the presence of wear in the middle and the first third of the surface of the natural key top on these instruments is a confirmation of the great influence exercised by Tomás de Santa María's 'clavichord tradition' on eighteenth-century Portuguese musicians.<sup>1</sup> Doderer relates the placing of this trace to Santa María's recommendation that the keys need to be struck at their front edges.<sup>2</sup> This interpretation somewhat oversimplifies the picture. For instance, no reference is made to the fact that Santa María associates this use of the finger with that of a lower wrist. Thus it appears that the potential effect of the position of the wrist on the action of the finger was not considered.

In the same vein, Siegbert Rampe points out that the bulges upon and on the front edge of the natural-key top of Mozart's fortepiano are indications of Mozart's use of a finger action similar to one described by Johann Nikolaus Forkel, namely, the withdrawing of the finger in the direction of the palm of the hand during the release

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<sup>1</sup> See Gerhard Doderer, *Clavicórdios Portugueses Do Século Dezoito = Portugiesische Klavichorde Des 18. Jahrhunderts* (Lisbon: Fundação Calouste Gulbenkian, 1971), 21 (Portuguese version); 22 (German version).

<sup>2</sup> Tomás de Santa María, *Libro Llamado Arte De Tañer Fantasia* (Valladolid: Francisco Fernandez de Cordova, 1565), f. 38 r.; translation in Barbara Sachs and Barry Ife, eds., *Anthology of Early Keyboard Methods* (Cambridge: Gamut publications, 1981), 11.



of the key.<sup>3</sup> He goes on to mention that this evidence can also be observed in ‘many keyboards from the sixteenth to the nineteenth century’. Although it is probable that during these centuries this movement held a prominent place in the playing practice of a number of performers—J.S. Bach included—it would be difficult to argue that those performers using it would have affected the key in exactly the same way.

As I will try to show, to a great extent the effect on the key of a particular mechanical approach (and, for the same reason, on some of the characteristics of the resulting sound) is defined by the spatial relationship between the instrument and the elbow, arm, wrist, hand, and finger joints. Moreover, the topology of the keyboard—namely, the form in which the keys are spatially arranged and dimensionally interrelated—and the effect of the instrument’s action on its touch would have called for distinct mechanical approaches from the performer. Thus, it will be necessary to attempt an identification of both the reasons behind the choice of a specific balance between these bodily elements and the instrument, and, if possible, the resulting physical abrasion of the key. Needless to say, the socio-cultural shaping of the body, and thus its impact on its biomechanical characteristics would also need to be considered at some point.

Both Doderer and Rampe do not elucidate how they reached their understanding of the trace of wear. Perhaps this was made possible by a visual evaluation of the trace. Or, in order to form themselves a ‘tactile’ image, they could also have manually applied a number of the characteristic movements of their suggested mechanical approach to the current trace of wear, something which might have helped them to surmise the trace’s mechanical origin. While these methods could provide us with valuable insight into the basic mechanics behind a key’s present morphology, they—given the complex combination of organological, biomechanical, musical, and socio-cultural variables already pointed out—might not be entirely satisfactory when trying to understand the trace of wear from a broader perspective.

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<sup>3</sup> See Siegbert Rampe, *Mozarts Claviermusik: Klangwelt Und Aufführungspraxis: Ein Handbuch* (Kassel: Bärenreiter, 1995), 48, 139–142, especially 142. The action of the finger to which Rampe refers will be discussed in chapter 2.

At this point, it is necessary to emphasise that my attempt here to understand the trace of wear ought to be seen as of a preliminary nature. The way in which the physical trace forms, as the picture presented above has shown, depends on issues which themselves call for an elaborated and extended analysis. However, it is hoped that this initial step will not only help to shed some light upon the more complex aspects behind the origin of the trace of wear, but will also contribute to an understanding of the trace which could ultimately enrich our views of a number of historical performance practices.

## **J.S. Bach**

When attempting an understanding of the evidence of wear on the surface of the keys of an early eighteenth-century clavichord two important issues would need to be considered. First, the instrument may have been played by one or more performers from around the period in which it was originally built.<sup>4</sup> Second, it is probable that the performer(s) playing at this instrument used a playing approach prevailing in that historical period. The physico-mechanical approach necessary to satisfactorily perform the music of the period had necessarily to account for the characteristics of the instrument's action and keyboard topology. If we want to facilitate an insight into the process behind the production of wear we would thus need to begin with a thorough assessment of the mechanical elements that might have been behind the production of the trace and propose a physico-mechanical approach. Another possible way is to choose a historical approach to the keyboard and try to find out if it, under certain conditions, will produce a trace similar to that present on historical instruments (see the discussion below on the experimental clavichord). In this survey of the trace of wear I propose to adopt the second solution. For this reason, it will be necessary to establish here two basic precepts which may assist in an effort to study this historical evidence:

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<sup>4</sup> It is important to emphasise that there is an unavoidable problem surrounding this approach, namely, the difficulty in establishing with any certainty the following information about the historical instruments studied in this survey: the period in which the instrument was played, the amount of playing time, the repertoire performed on it, the playing approaches used well outside its original period, etc. Despite the problems just pointed out, I suggest that careful study of the physical trace of wear might still deliver relevant information regarding playing practices of the past.

1) In order to facilitate an insight into the process behind the appearance of wear it will be essential to produce it in a controlled form. This will help to understand how wear is produced by a number of actions of the fingers. Consequently, an attempt to attribute a distinct wear pattern to a particular action or actions of the finger might become possible. The controlled production of wear will require the use of an instrument where it can be produced in a fast and reliable form, namely, an experimental clavichord.

2) In order to facilitate an identification of the mechanical characteristics of the movements responsible for the production of experimental wear a well-defined playing approach will be required. Here, I propose to use a reconstruction of J.S. Bach's physico-mechanical approach. While the character of this reconstruction is hypothetical it could still offer valuable insight into an interpretation of historical wear evidence.

A number of characteristic features that appear to have belonged to the manner in which J.S. Bach performed at the keyboard have been described by authors such as Johann Joachim Quantz, Nikolaus Forkel and Bach's son Carl Philip Emanuel Bach. Both nineteenth- and twentieth-century scholars have also examined a number of issues related to Bach's approach to the keyboard. These circumstances seem to favour a thorough visualisation of a number of important elements of Bach's approach which could lead to the preparation of a sound reconstruction of his physico-mechanical approach. This will serve here as a departure point for an understanding of some mechanical aspects behind the evidence of wear.

While the prospects of gaining a robust view of Bach's physico-mechanical approach look promising, there are, however, a number of issues surrounding some of his practices which are more problematic than they may, at first glance, appear. Two of these issues deserve special attention: 1) the fingering practice in which two adjacent fingers of the hand play an ascending or descending series of notes seems to have been used by Bach. So far as I can tell, there is no agreement among scholars as to the precise mechanical workings of these fingerings. Moreover, we do not know for sure in which manner Bach's hand operated when using this mechanical approach; 2) Johann Joachim Quantz reports that Bach used to withdraw the tip of

the finger from the key in the direction of the palm of the hand when playing quick passage-work. The presence of this approach in Bach's keyboard practice is also reported by Forkel. However, Forkel does not appear to restrict Bach's use of the withdrawing movement of the finger's tip to the sort of passages referred by Quantz.

In order to facilitate an insight into how fingers operated during the use of paired fingerings it will be necessary, I suggest, to investigate a number of historical approaches incorporating them, as well as inquire into the possible reasons behind the prevalence of these fingerings in a number of keyboard playing traditions. On the other hand, a re-evaluation of a number of historical sources in which Bach's touch is discussed might yield more specific information regarding the playing instances in which he may have withdrawn the fingers.

An understanding of the use of the fingers within certain circumstances might give access to a more nuanced view of their effect on performance within particular keyboard traditions. As I will attempt to show, this understanding relies on that of the specific patterns of movement of the arm, hand, and fingers resulting from the body's interaction with the instrument, whose characteristics are unique. Thus, in chapter 1 I will argue that paired fingerings seem to have originated in the performer's initial interaction with the particular topology of the keyboard of the medieval organ. This imposed a number of playing demands on the performer to which he or she seems to have responded in a natural manner, that is to say, by using a set of movements inherent to the physical nature of the arm, hand, and fingers. Despite the drastic changes that the topology of the keyboard has experienced over the years, a number of approaches originating in an interaction with the early keyboard, such as paired fingerings, remained in use for centuries. This situation, I will suggest, was primarily the result of the influence of tradition.

The manner in which the body engages in performance also depends on other factors such as the spatial positioning of the keyboard with respect to the performer's body. Chapter 2 explores how the varied positioning of the keyboard, observed in iconography, might have had an effect on the performer's physico-mechanical approach. Particular attention is given to the positioning of the wrist with respect to the surface of the keys, as described by some authors, and its possible effect on the

use of paired fingerings. In chapter 3—against this background, and with the aim to clarify a number of aspects related to Bach’s possible approach to the instrument—I will survey those accounts of Bach’s playing by Quantz, C.P.E. Bach and Forkel. Again, the instrument will be at the core of the discussion: an analysis of the impact of the action of the instrument on the key’s touch will help to shed some light upon some problematic notions derived from the reading of historical texts, particularly in the case of Emanuel Bach. Finally, from the information provided by this analysis a number of potential features of J.S. Bach’s approach to the keyboard will be listed.

The reconstruction of Bach’s touch used on the experimental clavichord not only helped to trace the effect on the experimental surface of specific mechanical movements of the fingers, thus becoming a valuable aid in an attempt to understand historical traces of wear. The time invested in the preparation of the chosen repertoire (i.e. the fifteen two-part Inventions BWV 772–786) also permitted me to observe in detail the manner in which the finger operates on a number of organologically contrasting clavichords. Hence, in chapter 4 I will examine the impact of the clavichord’s mechanics in the development of touch as well as on a number of performance issues. The second part of the chapter will introduce the idea that while in the interaction between the performer and the instrument the mechanical element is most apparent, one should consider that socio-cultural issues might have played a role in the manner in which the performer’s touch was developed. I will thus briefly argue that Bach’s touch, as well as that of a number of Lutheran musicians, might have been shaped by a view of music defined by religious beliefs.

The beginning of chapter 5 explores the significance of the keyboard instrument as a cultural object and document. While the intentional character of the performer’s mechanical action behind the evidence of wear cannot be summoned, it is nevertheless to be taken into account. This is because the instrument, as a technology of the intellect (i.e. a means of communication), is capable of influencing how our thoughts are delivered. The second part of the chapter goes on to explore the trace of wear present on a number of historical instruments. With the aid of the experimental clavichord—using the playing approach advanced in chapter 4—an attempt will be

made to ‘read’ the historical traces present on selected instruments. It is hoped that this evaluation of the evidence of wear will strengthen and expand the arguments derived from the analysis of the sources presented in earlier chapters.

## **The experimental clavichord**

In order to attempt an initial evaluation of the evidence of wear present on historical keyboard instruments it will be necessary to define and sharply delimit the sources of information concerning the production of wear. Here, an interpretation of the trace of wear will rely on the information derived from an analysis of historical documents such as paintings, biographies, descriptive accounts, and that obtained through the use of the experimental clavichord. This instrument is nothing other than a copy of a historical instrument which displays key tops made of a material with a high-wear rate. As a result of this situation, the tops will reveal patterns of abrasion more rapidly than those commonly used to cover the keys. The experimental clavichord will then be a valuable source of data, providing this study with specific information about the various stages of the abrasion caused by the finger’s contact with the surface of the keys.<sup>5</sup>

As stated above, the choice of this method results from the difficulty in reading and interpreting with reliability a number of details that can be observed in the various manifestations of wear present in historical keyboard instruments. That is to say, despite the fact that we can readily appreciate the abrasive effect of the finger action on the surface of the key, how this footprint came into existence is not entirely clear. Thus, the observance of certain conditions during the experimental monitoring of this process may bring into perspective important details regarding the way in which it takes place.

Next to an apprehension of the process behind the formation of wear the experimental clavichord also provides a much-needed reference point from which historical traces of wear could be compared. This may thus help to establish a number of possible finger actions explaining the present shape of some historical traces of wear. In other words, the experimental clavichord will help to facilitate an

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<sup>5</sup> This instrument’s technical information can be found in appendix 3.

insight into how particular fingers affected, through their mechanical actions, the surface of historical tops. On the other hand, the use on this instrument of a clearly defined historically-reconstructed technique means that a distinctive wear trace will be produced. Hence, if a number of similarities among the resulting experimental trace and that present in a number of historical instruments can be established, one could claim the presence of similar sets of movements to those used on the experimental clavichord in the practice of performers from particular historical periods and geographical regions.

Needless to say, any attempt to document this type of evidence through a controlled process will not have the accuracy one might find in a number of scientific fields. This is because some of the variables involved would not be easy to reproduce by others. This is particularly true in relation to a number of aspects of the performer's body (e.g. characteristics of the hand (weight/shape/length of the fingers/hand/arm; specific use of mechanical approaches, particular performance choices, socio-cultural upbringing, etc.). The experiment is thus unique in this respect.

The reasons for using a clavichord as the experimental instrument have to do with its particular touch. The clavichord is not an easy instrument to play. The touch needs to be carefully worked out in order to acquire a finger control which will allow the player to produce a good tone. As a result, a more specific type of wear might be found in some historical instruments. The clavichord was still at Bach's time the main instrument on which beginners learnt the principles of keyboard playing and on which organists practised. Thus, if one considers the difficulties posed by the touch of the instrument, and the importance teachers might have given to the correct assimilation of the principles of keyboard playing, it is probable that attention to the development of a good touch was particularly high.<sup>6</sup> For this reason, it is possible that the evidence of wear present in a number of historical clavichords speaks for a

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<sup>6</sup> Friedrich Wilhelm Marpurg suggests that playing the harpsichord helps to acquire the finger strength necessary to play on keyboard instruments. He also favours the use of the harpsichord since, due to its sustaining power, at this instrument it would be possible to detect if the pupil is using a longer touch than that necessary (i.e. that in which, in Emanuel Bach words, the fingers seem to be glued to the key). See Friedrich Wilhelm Marpurg, *Anleitung Zum Clavierspielen* (Berlin: Haude und Spener, 1755), Introduction, § 4; and Carl Philipp Emanuel Bach, *Versuch Über Die Wahre Art, Das Clavier Zu Spielen* (Berlin, 1753), Introduction, § 15.

significantly more elaborated and mechanically worked-out touch than that which was necessary when playing on the harpsichord or the organ.

The clavichord was not only used by organists. It also became a favourite among amateurs. Given the character of the use of the instrument a number of clavichords might contain characteristic wear evidence corresponding to the practice or practices of single, or a small group of, performers. Although it would not be possible to ascertain the presence of a similar playing approach among the people who played an instrument, the instrument might contain a type of evidence that would be difficult to find on the organ—given the tendency to use this type of instrument well beyond the period in which it was originally built.

The interpretative difficulties entailed in this study are numerous. However, it is hoped that the results of the analysis of the trace of wear will help to establish the potential value of the information obtained from the instrument for the further study and understanding of historical performance practices.



# 1 The role of keyboard organology in the development of a mechanical approach to the keyboard

To a large extent the shape of an instrument determines its fingering.

C.P.E. Bach, *Versuch*, Ch. 1, Fingering, § 1.<sup>1</sup>

During the second half of the seventeenth century fingerings in which the use of the thumb played a central role began to permeate keyboard performance practices. By the end of the eighteenth century these fingerings were becoming ubiquitous, a clear indication of the definitive turn towards homogenization that fingering practices were taking. However, in previous centuries the presence of a variety of fingering approaches can be clearly observed. In spite of this situation, the origins of these different approaches to fingering are the same in each case, namely, in the physical relation between the various topologies of the keyboard of the medieval organ and the biomechanical characteristics of the body of the performer. This relation seems to have granted the three middle fingers of the hand a predominant role in playing. The leading role of these in fingering systems from the sixteenth to the eighteenth centuries is confirmed by the extended discussions of their use in a number of historical treatises. Although the way the fingers were used differed in some particular instances (e.g. in accented and unaccented notes) the presence of the finger relationship short-long-short-long (or the other way around) can be found in all these discussions.

The presence of similar fingering principles in a number of historical periods in which contrasting musical practices can be found speaks of a highly adaptable approach which allowed performers to achieve their various performance aims. In this chapter I will attempt to show that the prevalence of these fingerings had to do

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<sup>1</sup> Ibid.; the translation is taken from Carl Philipp Emanuel Bach, *Essay on the True Art of Playing Keyboard Instruments*, ed. and trans. William J. Mitchell (New York: W. W. Norton, 1949).

with their naturalness: they are rooted in a relation between the player's bodily biomechanical characteristics, and the mechanical requirements and the topology of the keyboard design of the medieval organ. Thus, the prevalence of these fingerings, to a great extent, has to do with the physico-mechanical aspects behind their initial development. For this reason, and in order to understand their impact on the uses of the body of the performer, I will examine a number of aspects related to the organology of the organ's keyboard and the changes it went through after the medieval instrument gained its keyboard.

Successive changes in the topology of the keyboard design appear to have resulted in a re-exploration of the physical approach to the keyboard. However, the basic short-long-short-long fingerings remained in currency for a long time. This might have been in part a result of the weight of tradition. Paired fingerings receded and disappeared during the early nineteenth century. Nevertheless, the use of paired fingerings continued in particular circumstances (e.g. while playing in the so-called 'easy keys'), while the use of the thumb as the principal finger was gradually accepted—a development driven, in part, by the exploration of the 'difficult keys'. This situation can be observed in the practice of performers such as J.S. Bach and his son C.P.E. Bach who appear to have been at ease using either system. This would seem to suggest that, for some performers, the body's biomechanical characteristics and the keyboard's topology were still, to some extent, aspects that needed to be taken into account when making fingering choices.

In 1720 Johann Sebastian Bach presented his first son, the then nine-year-old Wilhelm Friedemann, with a small notebook. Both father and son were to fill in its pages during the following years with both music and information on keyboard playing.<sup>2</sup> After the dedicatory page that opens the volume, the manuscript presents its reader with information regarding clefs and the designation of pitches in relation to each of them. In the verso of the same leaf, a table is found in which a number of

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<sup>2</sup> For detailed information about its history and contents, see Wolfgang Plath, *Klavierbüchlein Für Wilhelm Friedemann Bach: Kritischer Bericht* (Kassel: Bärenreiter, 1963); Johann Sebastian Bach, *Clavier-Büchlein Vor Wilhelm Friedemann Bach. Facsimile Edition*, ed. Ralph Kirkpatrick (New Haven, Conn: Yale University Press, 1959).

ornaments are presented in their notation and basic realization. The next page, headed I.N.I. (In Nomine Iesu), contains the manuscript's first musical piece: the *Applicatio*. This is an eight-bar composition that, with the exception of a Praeambulum in G minor (BWV 930) is the only piece in the entire manuscript that has been provided with comprehensive fingerings. These two pieces are also the only known examples in Bach's hand in which we have first-hand information regarding his fingering practices.<sup>3</sup>

The *Applicatio* has for many years fuelled conjectures about Bach's use of what we nowadays know as 'early fingerings'.<sup>4</sup> For this reason, and in order to try to shed some light upon what the fingerings can tell us about the shaping of the melodic lines in this composition, a brief exploration of the piece and its directions on fingering is needed at this point. Let us begin by considering the tonality of the piece. According to Carl Philip Emanuel Bach, C major provides one of the most favourable settings for the use of crossed fingerings.<sup>5</sup> Speaking of those keys with few or no accidentals, the so-called easy keys, he states in his 1753 *Versuch über die wahre Art das Clavier zu spielen* that

[...] das Ueberschlagen des dritten Fingers über den vierten und des zweyten über den Daumen besser und nützlicher [ist], um alles mögliche Absetzen zu

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<sup>3</sup> Another work in the manuscript that appears to contain fingerings emanating from Bach's practices is the prelude and fugetta BWV 870a. Although the handwriting is that of Johann Caspar Vogler, it has been written down in paper known to have been originally in Bach's possession. See Mark Lindley, "Early Fingering: Some Editing Problems and Some New Readings for J.S. Bach and John Bull," *Early Music* 17, no. 1 (1989), 65; and Quentin Faulkner, *J.S. Bach's Keyboard Technique: An Historical Introduction* (St. Louis MO: Concordia, 1984), 21–38, especially 23–24.

<sup>4</sup> There is a large body of literature in which the topic of early fingerings is discussed. See, among others, Howard Ferguson, *Keyboard Interpretation from the 14th to the 19th Century: An Introduction* (New York: Oxford University Press, 1975), 67–84; Mark Lindley and Maria Boxall, eds., *Early Keyboard Fingerings: a Comprehensive Guide* (London: Schott, 1992); Richard Troeger, *Technique and Interpretation on the Harpsichord and Clavichord* (Bloomington & Indianapolis: Indiana University Press, 1987), 35–64; Harald Vogel, "Keyboard Playing Techniques Around 1600," in *Tabulatura Nova*, ed. Harald Vogel, vol. II (Wiesbaden: Breitkopf & Härtel, 1998), 145–171; Harald Vogel, "Playing Techniques," in *Jan Pieterszoon Sweelinck, Complete Keyboard Works, Toccatas*, ed. Harald Vogel and Pieter Dirksen, vol. 1 (Wiesbaden: Breitkopf & Härtel, 2005), 105–123; Ludger Lohmann, *Studien Zu Artikulationsproblemen Bei Den Tasteninstrumenten Des 16.-18. Jahrhunderts* (Regensburg: G. Bosse, 1982), 133–184. In relation to Bach, see above, note 3. See also the discussion on fingering in chapter 2 below.

<sup>5</sup> That is to say, those in which a long finger vaults its neighbour, which is shorter. The only exception is the crossing of the fourth over the fifth finger which, according to Emanuel Bach, is only to be used in specific circumstances. See Bach, *Versuch*, Ch. 1, § 25, 27, 28, 30 and 93. See also Vogel, "Keyboard Playing Techniques Around 1600," 145–147, for a subdivision of these fingerings.

vermeiden, als der übrige Gebrauch des Ueberschlagens und das Untersetzen des Daums [...]

[...] the crossing of the third finger over the fourth and the second over the thumb is in certain cases more practicable and better suited [in these keys] for the attainment of unbroken continuity than other crossings or the turn [of the thumb...]<sup>6</sup>

But the performer must be aware that

[...]as Untersetzen und Ueberschlagen als die Haupt-Hülffs-Mittel in der Abwechslung der Finger müssen so gebraucht werden, daß alle Töne dadurch gut zusammen gehänget werden können.

[...]the crossing [over of the fingers] and turning [of the thumb], the principal means of changing the fingers, must be applied in such a manner that the tones involved in the change flow smoothly.<sup>7</sup>

For Emanuel Bach these tonalities are ‘much more challenging and elusive than the so-called difficult ones’.<sup>8</sup> The reason for this, he points out, lies in the fact that the easy keys allow more fingering possibilities: while some tonalities, such as E minor, ‘[have] only one good fingering’,<sup>9</sup> C major allows three different ones, none of which is impracticable.<sup>10</sup> He observes, however, that those ‘in which the third finger of the right hand crosses the fourth, the second of the left hand crosses the thumb, and the thumbs strike *f* are perhaps more usual than the others’. The first two fingerings described by Emanuel are precisely those found in the *Applicatio*.<sup>11</sup>

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<sup>6</sup> Bach, *Versuch*, Part 1, Ch. 1, § 64.

<sup>7</sup> Ibid. Ch. 1, § 64.

<sup>8</sup> Ibid. Ch. 1, § 63. In the same paragraph Emanuel Bach states that the difficult keys are called in this form ‘because they are never or, at best, rarely played or used in their own right’.

<sup>9</sup> Ibid. Ch. 1, Fingering, § 37.

<sup>10</sup> Ibid. Ch. 1, Fingering, § 30.

<sup>11</sup> Ibid. Ch. 1, Fingering, § 30. Emanuel Bach’s scale example provides no indication of rhythm. This is because, as derived from § 29, there is no distinction in terms of specific fingers having to play accented or unaccented notes. This idea is perhaps related to Emanuel Bach’s commentary on his father’s fingers: ‘All his fingers were equally skilful; all were equally capable of the most perfect accuracy in performance’. See Hans-Joachim Schulze, ed., *Bach Dokumente 3: Dokumente Zum Nachwirken Johann Sebastian Bachs, 1750-1800*, (Kassel, Leipzig: Bärenreiter, Deutscher Verlag für Musik, 1972), no. 666; Hans T. David, Arthur Mendel, and Christoph Wolff, eds., *The New Bach Reader: a Life of Johann Sebastian Bach in Letters and Documents* (New York: W.W. Norton, 1998), no. 306, 306. Thus, all the fingers would in principle be capable of playing in any of the two situations. One example would be the ascending scale in bar 3 of the *Applicatio*: the initial *c* is taken with the third finger to create a particular articulation between this note and the *B* in the previous bar. This brings the thumb to play an *e* instead of Emanuel’s suggested *f* for those fingerings using the

In the statements presented above, Emanuel Bach appears to be suggesting that due to the variety of fingering options they present to the player, particular attention has to be given to the study of the easy keys. At the same time, he insinuates that these fingerings were those more often found among performers of his lifetime. The information from the *Applicatio* would seem to indicate that this group included his father: the decision to introduce the readers of the *Versuch* to fingering specifics through a discussion of appropriate fingerings in scale patterns resembles the approach taken by J.S. Bach—condensed in the *Applicatio* but certainly not during oral instruction—which helped Friedemann attain the mastery for which he was later well known (see below). Scale patterns thus offer the starting point for learning correctly the two techniques described by Emanuel for changing the fingers:<sup>12</sup> *das Untersetzen*, or the turning of the thumb, and *das Überschlagen*, or the crossing of the fingers.<sup>13</sup>

The fact that a greater variety of fingering possibilities was available in easy keys might not be the only reason behind Emanuel's emphasis on their difficulty. His recommendation to practice the crossing of the fingers until these do not 'interlock' suggests that the required physical ability is hard to acquire. But in spite of this, he never advises his readers to eschew them.<sup>14</sup> On the contrary, he not only proposes that the use of the turn of the thumb in the easy keys might be less useful for the purposes of unbroken continuity; he also calls attention to the fact that the thumb is not completely comfortable when lacking the space created when the keyboard's

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pattern 4–3–2–1–2–1–2–1 or 4–3–2–1–4–3–2–1 (beginning with *c*). Another instance of this flexibility is found in bar 7 where the initial *a* in the bass is taken with the second finger, and the *f* in the second half of the bar, another accented note, with the third.

<sup>12</sup> Bach, *Versuch*, Ch. 1, Fingering, § 29.

<sup>13</sup> Ibid. Ch. 1, Fingering, § 25–27. When considering Emanuel Bach's views on fingering one must not forget his observation with respect to his predecessors. These 'were more concerned with harmony than melody and played in several parts most of the time [...]'. In contrast with this style, melodic passages are more 'capricious' in relation to fingering. See *ibid.* Ch. 1, Fingering, § 6.

<sup>14</sup> Ibid. Ch. 1, Fingering, § 27. The reasons behind Bach's decision to preserve these fingerings despite their mechanical demands might have to do with his perception of how serviceable they could be once the player is in full command of them. But their effortless and skilful use in Bach's musical idiom and contemporary keyboard topologies might have called for a more elaborated degree of physical control than that the topologies where these fingerings originated—and the contemporary idioms they originally served—required. See the discussion below.

chromatic keys are involved.<sup>15</sup> It comes then as a surprise that, in an apparent disregard for these ideas, Daniel Gottlob Türk, in his 1789 *Klavierschule*, recalls the exceptional physicality of Emanuel's brother as the particular reason behind his extraordinary ability in playing with crossing fingerings:

Der verstorbene Friedemann Bach [...] soll mit diesen beyden Fingern, wie man hier allgemein behauptet, gewisse läufer rund und mit einer erstaunenswürdigen Geschwindigkeit heraus gebracht haben. Von einem Friedemann Bach läßt sich dieses gar wohl denken zumal da auch der Bau seiner Hände und Finger manches Eigene gehabt haben soll.

The now-deceased Friedemann Bach [...] was supposed to have performed certain runs with these two fingers [e.g. the third finger crossing over the fourth in both hands] with smoothness and an astonishing rapidity. From a Friedemann Bach this could be expected, particularly since the construction of his hands and fingers were supposed to have had many unique characteristics.<sup>16</sup>

Let us recall that in the *Versuch*—chapter 1, § 18—Emanuel Bach states that his teaching of the principles of fingering is based on 'nature'.<sup>17</sup> In subsequent paragraphs, he proceeds to describe these principles which appear to be based on his observations of the specific physico-mechanical relationship,<sup>18</sup> within specific performance conditions, between the hand, the fingers, and the distinctive characteristics of the keyboard design.<sup>19</sup> His recommendation in favour of the use of

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<sup>15</sup> Ibid. Ch. 1, Fingering, § 64. The space necessary to allow the movement of the thumb might be behind a number of seventeenth- and eighteenth-century points of view regarding the height of the wrist. See Lohmann, *Studien Zu Artikulationsproblemen*, 99–101.

<sup>16</sup> Daniel Gottlob Türk, *Klavierschule Oder Anweisung Zum Klavierspielen Für Lehrer Und Lernende*, ed. Siegbert Rampe, Facsimile (Kassel: Bärenreiter, 1997), part II, § 19. Translation in Daniel Türk, *School of Clavier Playing, Or, Instructions in Playing the Clavier for Teachers & Students*, ed. and trans. Raymond H. Hagg (Lincoln: University of Nebraska Press, 1982), 146.

<sup>17</sup> A variety of meanings were attached to this word during the first half of the eighteenth century. See, for instance, Johann Heinrich Zedler, *Grosses Vollständiges Universal-Lexicon Aller Wissenschaften Und Künste* (Halle und Leipzig: Verlegts Johann Heinrich Zedler, n.d.). *Natur, Natura*, vol. 23, col. 1035–1038. Emanuel Bach probably considers the word 'nature' in a physical sense, that is to say, his idea of nature arises from a thorough examination of the biomechanical capacities of the body.

<sup>18</sup> In this thesis I will use the term physico-mechanical to refer to the relationship defined by the biomechanical characteristics of the body and the mechanical requirements imposed by the keyboard instrument. For a more extended discussion on this term, see the introduction above, and chapter 2, pp. 68–69.

<sup>19</sup> The absence of metrical indications in the scales that accompany the fingerings in the *Versuch* suggests that Emanuel Bach might have expected that a full command of paired-finger technique would also allow performers to easily play ascending or descending scales in any rhythm pattern. In other words, when paired fingerings were carefully practiced the physico-mechanical correlation resulting from their use might have allowed performers to play in an effortlessly manner within a variety of metrical situations and at various speeds of playing.

crossed fingerings in the specific circumstances described above appears thus to derive from a thorough understanding, resulting from experience, of the physical relationship between the hand, the fingers, and the keyboard design. For Emanuel, and possibly also for his father, these fingerings, in certain circumstances, granted great facility in playing, since they were considered to take fully into account both the physical qualities of the hand and the topography of the keyboard. Thus, by recommending the use of crossed fingerings whenever the thumb was not practical (because of the space and comfort it requires to work at its best), Emanuel Bach is advocating the use of a practicable system of fingerings more adequate to the task. But for Türk, who considered that crossed fingerings require much more practice before the player in using them is able to avoid breaking the continuity of a line,<sup>20</sup> Emanuel's principles and the argumentation behind them seem not to suffice. He, however, does not go as far as to rule out their practical use; but his suggestion that 'one could do without them'<sup>21</sup> points to the homogenization of fingering practices taking place during the second half of the eighteenth century. Türk appears to be making a tacit recommendation in favour of the thorough use of a basic principle in all scale patterns, namely, the ubiquitous application of the turn of the thumb.

The prevalence for more than two centuries of fingering systems in which the fingers cross could be seen as an indication of how they were perceived to be useful within specific keyboard composition idioms, a manifestation of the zeal with which tradition was preserved, and a sign that there was an awareness of a particular relationship existing between the musician's body and his instrument. It is, indeed, precisely from the exploration of the relationship between body and mechanism that a characteristic keyboard idiom arises. For this reason, in the next section of this chapter, I will attempt to show the issues that may lay behind the adoption of distinctive approaches to the keys.

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<sup>20</sup> Türk, *Klavierschule*, Ch. II, Part II, § 19.

<sup>21</sup> Ibid. Ch. II, Part II, § 20.

## **An organological basis for the understanding of keyboard playing techniques**

I have suggested above that one of the reasons behind the preservation of crossing fingerings might have to do with the workings of tradition. It will thus be informative to try to trace how this distinct approach to the keyboard became prevalent. A most illuminating departure point in an investigation of the origins of this tradition can be found in the study of the relationship between the hand, the finger and the keyboard design.

An artefact is in principle designed to be handled in a particular form. Thus, the physical approach necessary to operate it would be known in advance. However, while the particular approach to the keys of the earliest organs appears self-evident in hindsight (i.e. the keys would have been operated using the fingers) this might not have been the case with the first medieval positive organs displaying keys rather than sliders. Around the time in which the medieval organ gained its keyboard—i.e. a set of levers which, when pressed downwards, activated the mechanism that allowed the air to go into the pipes<sup>22</sup>—distinctive building approaches might have given the keyboard a number of regional variety of characteristics. Thus, a hypothetical geographically-unbounded contemporary observer might have found a large variety of key shapes and sizes—perhaps displaying a heavy touch—as well as dissimilarity in the spacing between them in different instruments. At the same time he might have been in the position to witness the practices used in the playing of those organs in which the slider was directly operated by the hand. One can only speculate about the possible approach given to the new keys by those performers used to operating instruments with hand sliders.<sup>23</sup> Thus, the following discussion advances some hypotheses based on what little we know about this transitional period.

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<sup>22</sup> The use of the key lever as a mechanical element of the organ action was probably regained during the thirteenth century through Arabic transmission of early Greek science and technology knowledge. See Joseph Smits van Waesberghe, *Musikerziehung: Lehre Und Theorie Der Musik Im Mittelalter* (Leipzig: VEB Deutscher Verlag für Musik, 1969), 164; Arnfried Edler, ed., *Gattungen Der Musik Für Tasteninstrumente*, vol. 7.1 (Laaber: Laaber-Verlag, 1997), 15.

<sup>23</sup> Given the available historical evidence it cannot be established with any degree of certainty how the first organ keys were initially operated. Some evidence suggests that fingers, at least in the early days of the medieval keyboard, were not used in the modern way. For a discussion on the possible playing technique used on the early-keyed organ, see appendix 1; on Hero of Alexandria's organ design (1<sup>st</sup> century CE; earliest copy, 1250), where the key lever that might have influenced the building of the



Regardless of the multifarious panorama described above it might be possible to distinguish general principles in relation to early organ playing technique from which particular approaches could have arisen. One of these principles is *adaptation* which in keyboard playing is related to the need to adjust the action of the hand and the fingers to the given topology of a specific keyboard design. This principle is no less valid when considering other keyboard instruments.

One of the most basic and probably earliest designs of the keyboard is based in the grouping of a series of levers in a single horizontal plane, one next to the other. This configuration most probably derives from that found in organs in which the slider was pulled in order to allow the air to enter the pipe.<sup>24</sup> However, while on these instruments the slider undertakes a horizontal movement, the activation of a levered key takes place when the performer presses down the lever's front. In this system, one finds that the player will require two basic movements to operate the keyboard, namely,

1. a vertical movement required to press down the key;
2. a lateral movement which is necessary to reach any other key after an initial one has been activated.

These movements are generic and occur regardless of the particular measurements of the keys, the space between each of them, or the keydip. However, the addition of these variables—and specific ways to use the fingers and the hand—will demand from the performer a distinctive approach to each keyboard type. Thus, when measures of length, width, and depth are introduced (and the question of force is excluded), the player may choose to lower the key aided by the fist, a combination of fingers, or by using a single finger.<sup>25</sup> The particular conformation of individual keys

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keyboard of the medieval organ can be observed, see Jean Perrot, *The Organ, from Its Invention in the Hellenistic Period to the End of the Thirteenth Century*, trans. Norma Deane (London: Oxford University Press, 1971), 28–34, especially 32, and plate XXIII.

<sup>24</sup> Images of instruments in which sliders are present can be found in the *Rhineland Psalter* and the *Harding Bible*. See *ibid.* plate XXV, 1 and 2; and Christopher Page, “The Earliest English Keyboard,” *Early Music* 7, no. 3 (1979): 310.

<sup>25</sup> Michael Praetorius suggests that some early keys would have been played with the fists given the difficulty to pull them down. See Michael Praetorius, *Syntagma Musicum II: De Organographia*,

and the characteristics derived from their grouping might allow, limit, or impede the application of any of the above proposed approaches (e.g. in a keyboard where the keys are small and close to each other, the fist might not be able to strike a single key without coming into contact with those surrounding it. The use of the fist under these circumstances may then be safely ruled out. On the other hand, the design of a carillon keyboard does not favour the use of the fingers).

As is apparent from iconographical sources, the pin action and the closeness of the small buttons and hinged plates in some medieval portative organs stimulated the use of individual fingers.<sup>26</sup> Moreover, button keyboards, in particular, might also have facilitated and encouraged an increase in the playing speed. These issues might have aroused an interest in having smaller and closer keys on larger instruments which would have allowed a subsequent use of the fingers on these instruments.<sup>27</sup> But the condition in which the keys were close enough to allow this kind of playing in large positive organs might not have been attained in a short period of time; devices needed to be contrived which would permit a smaller keyboard to be able to efficiently activate the larger mechanism of the organ. At some point, performers finally would have come across a keyboard in which the keys were not too broad and separated. However, these keys could still have been of a size that would not yet have permitted the sort of agile performance possible on a portative organ (required for the performance of the repertoire in the Buxheim organ book of c.1470, for instance)—even if playing of this kind was in fact ever attempted on larger instruments. This state of affairs might have encouraged players to devise a variety of approaches to the keys of the early, but larger, positive organs. One example will help to illustrate the variety in approach that was taken, while helping to broaden our understanding of early keyboard playing techniques and their relation to particular instruments in a given historical period.

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Facsimile (Wolffenbüttel: Elias Holwein, 1619), part III, Ch. V, 97. For some considerations on the possible existence of such a keyboard, see appendix 1.

<sup>26</sup> A small thirteenth-century portative which seems to be played by using the fingers on wood plates can be seen in Bernard Brauchli, *The Clavichord* (Cambridge: Cambridge University Press, 1998), 18, plate 1.8. The plate might have been hinged at its back end.

<sup>27</sup> One example of the use of keys, and fingers, on organs during the thirteenth century is the depiction of King David in the *Rutland Psalter*. See Perrot, *The Organ*, plate XXVII, 2.

## The Norrlanda organ's keyboard

The National Historical Museum (Historiska Museet) in Stockholm houses the remains of a late fourteenth century organ of which its keyboard and pedalboard have been preserved almost intact.<sup>28</sup> This instrument could not only aid in an understanding of aspects of early organ building, but also a visualization and reconstruction of some historical keyboard playing practices.

The distinctive keyboard of this instrument, the earliest preserved one, is characterized by the clear separation existing between the rows of natural and chromatic keys, and the presence of the *b* flat keys among those of the natural row. All the keys and the pedalboard protrude from the same vertical plane which runs from above the upper row of keys to the bottom of the instrument (see plate 1.1). Above the chromatic keys of this instrument a light-colour strip is found in which organ-notation letters have been inscribed. These letters indicate the name of the diatonic key right below. This is characteristic of many organs of the period, including those found in iconographical sources.<sup>29</sup>

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<sup>28</sup> For information on this instrument, see Edwin M. Ripin, "The Norrlanda Organ and the Ghent Altarpiece," in *Studia Instrumentorum Musicae Popularis III: Festschrift to Ernst Emsheimer on the Occasion of His 70th Birthday, January 15th, 1974*, ed. Gustaf Hilleström (Stockholm: Nordiska Musikförlaget, 1974), 193–196, 286–288; Peter F. Williams, *A New History of the Organ from the Greeks to the Present Day* (Bloomington: Indiana University Press, 1980), 50; and Peter F. Williams, *The Organ in Western Culture, 750-1250* (Cambridge: Cambridge University Press, 1993), 307. Various dates for the origin of this instrument have been suggested by different authors. The date c.1350 is suggested in Friedrich Jakob, "Orgel: IV. Die Orgel Des Westlichen Kulturkreises Im Mittelalter," *Die Musik in Geschichte Und Gegenwart*, 1997, columns 916–918; on the other hand, Kimberly Marshall, in the article on the positive organ in Douglas Bush, ed., *The Organ: An Encyclopedia* (New York: Routledge, 2006) suggests c.1400. Other authors allocate dates within these two time borders.

<sup>29</sup> On the letters of the monochord, see Waesberghe, *Musikerziehung*, 82.



**Plate 1.1 The Norrlanda organ, National Historical Museum, Stockholm**

When observed from the front side the keys of this instrument show a curved profile; if the keyboard is viewed from above each key of the lower row is perceived as a rectangle, the chromatic keys almost as a square.<sup>30</sup> The keys in the lower row do not show tails as those present in later keyboard designs. Thus, the rectangular surface ends almost at the point at which the front panel hides the rest of the key lever. The reason for this is that the upper-row keys are placed at a much higher level in comparison to those present in later keyboard designs. Hence, when pressed down, the higher keys do not get to touch those in the lower row. No space is therefore required at the back of the diatonic keys to allow the chromatic keys to operate unobstructed.

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<sup>30</sup> Kimberly Marshall incorrectly states that the keys of the upper and lower rows of this instrument are all of the same size. See Kimberly Marshall, “The Development of the Organ Keyboard,” in *Music and Its Questions: Essays in Honor of Peter Williams*, ed. Thomas Donahue (OHS Press, 2007), 14. See table 1.1 below for detailed measurements of the keys.

The levers belonging to the upper row of chromatic keys might have made their appearance gradually rather than at once as has been suggested.<sup>31</sup> Some written sources suggest that the chromatic keys appeared not only in stages but that those initially required were not the same everywhere (e.g. during the first half of the fourteenth century Johannes de Muris mentions keys for *f*<sup>#</sup> and *g*<sup>#</sup>, and around 1330 Jacobus of Liège wrote that on the organ ‘the tone is almost everywhere divided into two semitones’).<sup>32</sup> If the written evidence is inconclusive, at least one fragment of a Scandinavian organ suggests that the chromatic keys appeared gradually: a section of an organ board features similar organ-notation letters to those present in the Norrlanda organ.<sup>33</sup> Aided by this fragment one can determine not only the diatonic compass of the keyboard of the instrument to which it belonged (i.e. *c-g*’, thus shorter than the Norrlanda organ compass by two notes (*c-a*’))—but also the number of chromatic keys originally present (i.e. three rectangular holes below the letter strip suggest *c*<sup>#</sup>, *f*<sup>#</sup>, and *c*<sup>#</sup>’ were available).<sup>34</sup> Moreover, the placing of these holes in the board seems also to confirm that the chromatic and diatonic keys were separated in two rows. Unfortunately, the fragment does not help to determine the precise width of the gap, if any, between these last (see plate 1.2).

<sup>31</sup> Based on her consideration of the Norrlanda organ, organ fragments from the Gotland island, and sources referring to the organ after Theophilus and the Berne treatise, Kimberly Marshall suggests that ‘the move from diatonic compass to a fully chromatic one happened abruptly rather than through a gradual addition of chromatic notes’. See *ibid.* 11.

<sup>32</sup> See Nicolas Meeùs, “Keyboard,” *Grove Music Online* (Oxford University Press, 2012). The complete passage in which this statement is found reads: ‘it may be possible to place an intermediate note between *A* and *B* and to divide the tone there into two unequal semitones, as is done on some artificial instruments such as organs, on which almost everywhere the tone is divided into two unequal semitones so that several chants may be played there and several consonances and counterpoints obtained; nevertheless this is not useful with respect to the chant of the human voice’. Quoted in Nicolas Meeùs, “The Origin of the Chromatic Keyboard Layout,” *FoMRHI Quarterly* 46, no. 778 (1987): 43. Seen in context, the passage seems to suggest that the tone Jacobus of Liège refers to in the phrase ‘almost everywhere the tone is divided into two unequal semitones’ is exclusively that between *A* and *B*, and that it is only this which appears divided in some organs throughout its compass. This would not necessarily mean that a key separated from the diatonic row (i.e. a raised key) was to be used. See the discussion below on Sebastian Virdung’s clavichord keyboard woodcuts. See also Kimberly Marshall, *Iconographical Evidence for the Late-medieval Organ in French, Flemish, and English Manuscripts*, vol. 1 (New York; London: Garland Pub., 1989), 86–88. Michael Praetorius suggests that semitonia appear around 1200. See Praetorius, *Syntagma Musicum II: De Organographia*, part III, Ch. IV, 95. See also Ch. XIII, 109 (*Enderung und vermehrung der Clavirn*) for a representation of the shape of the keys (which also appears in Ch. V, 97, and tables XXIV and XXV) and an indication of their measurements (i.e. 2 ½ Zoll wide which, for Praetorius, is a measurement equivalent to the wide of three fingers. When considering the three middle fingers of my own hand, this amounts to approximately 6 cm).

<sup>33</sup> This board is also housed at the National Historical Museum in Stockholm, cat. no. 13068.

<sup>34</sup> At the far left side of this fragment two letters in a larger size than those belonging to the diatonic keyboard confirm the presence of the notes *E* and *G*.



**Plate 1.2 Fragment of a thirteenth (?) century Swedish organ board, Anga Church, Gotland, National Historical Museum, Stockholm, cat. no. 13068**

I suggest that the two separate key rows in these organs may attest to an absence of stringed keyboard instruments, or their transient lack of chromatic-key levers. This idea arises from the consideration that contemporary stringed instruments—such as the psaltery and the monochord from which the harpsichord and the clavichord probably derive—present a single string band level which would mean that raised keys similar to those of the organ would have been difficult to accommodate. Hence, all the keys in keyboards with balanced action, such as the harpsichord and the clavichord, would basically have had the same key surface level. Chromatic keys could have been accommodated among the natural ones—as it is just the case of the *b* flat key, which is found in the natural row in the Norrlanda organ. The new keys could then have been distinguished by staining them (which might have given the keyboard a chequered appearance), by marking the keys with organ notation, or by adding a name board at the back of the keytops in which the organ notation was to be written out. This arrangement was probably abandoned, if it ever existed, as it would have disrupted the continuity of the natural keys. It is at some point during the thirteenth century that some builders of the early clavichord, and perhaps the harpsichord,<sup>35</sup> might have started to furnish their instruments with the corresponding keys by using a different organological solution derived from the organ's two-row keyboard arrangement. This was to be the alteration of the chromatic key's playing-surface level by means of a keytop in the form of a block. This would have to be attached to the front edge of the chromatic key whose lever should in principle have shared the same horizontal level as that of the diatonic ones. In the case of instruments such as the Norrlanda organ a similar approach to the chromatic keys could have been adopted. However, a possible still scant use of the chromatic notes

<sup>35</sup> On the topic of builders, see Standley Howell, "Medical Astrologers and the Invention of Stringed Keyboard Instruments," *Journal of Musicological Research* 10, no. 1 (1990): 1–17; and Edmund A. Bowles, "On the Origin of the Keyboard Mechanism in the Late Middle Ages," *Technology and Culture*, 7, no. 2 (1966): 152–162.

contained in this row did not call for their closer positioning to the diatonic one. In other words, it appears that, considering the musical demands of the period at the time the instrument was built, the place of the chromatic notes in this double-row keyboard design lay within comfortable reach of the performers' fingers. At the same time, being shorter, and perhaps slightly narrower, than those in the diatonic row the chromatic keys would have not obstructed the playing on the diatonic one.

One can more readily observe the contrast between the keyboard of the Norrlanda organ and later designs when some of its basic measures are compared with those of a sixteenth-century keyboard. Let us consider a polygonal virginal built in Venice in 1540 by Domenico Pisarenis<sup>36</sup> (see Table 1.1).

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<sup>36</sup> This instrument is housed at the Germanisches Nationalmuseum, Nurnberg, cat. no. MIR 1081. See also Donald H. Boalch, *Makers of the Harpsichord and Clavichord, 1440-1840*, ed. Charles Mould, 3rd ed. (Oxford: Clarendon Press, 1995), 293.

Instrument	Length of the diatonic plate	Distance between the fronts of the diatonic and chromatic plates	Width of the diatonic plate	Width of the chromatic plate	Distance between the surface of the plates
<b>Norrlanda Organ</b>					
(second half 14 <sup>th</sup> century)	52.2 mm <sup>37</sup>	33.6 mm	31.1 mm	27.9 mm <sup>38</sup>	32 mm <sup>39</sup>
<b>Polygonal virginal by Domenico Pisarenis (1540)</b>					
	35.4 mm <sup>40</sup>	35.4 mm	23.1 mm <sup>41</sup>	11.6 mm <sup>42</sup>	8.1 mm

**Table 1.1 Comparison between measures belonging to two instruments with different keyboard designs**

A contrasting playing approach to that needed on keyboard designs such as those present on the harpsichord and the clavichord was probably necessary. This is suggested by the fact that the chromatic-key playing surface on the Norrlanda organ is found, when compared to that on the Pisarenis virginal, at a level around four times higher than that of the diatonic one. This also seems to indicate that the music played on instruments bearing this kind of keyboard probably made a more limited use of chromatic notes. Music such as that found in the c.1320 Robertsbridge Codex indicates that fully chromatic keyboards were already available at this time.<sup>43</sup>

However the tempo that some of the parts found on this repertoire seems to call for (e.g. a slow-moving against a fast-moving one), and the secular character of some of

<sup>37</sup> The first key to the left of the keyboard (*c*) was used as the basis for these measurements.

<sup>38</sup> Measure has been taken from the first chromatic key to the left of the keyboard (*c*#).

<sup>39</sup> Both plates are curved. This measure reflects the distance between the highest points of both keys. The key levers were placed at the highest point allowed by the panel openings before measuring.

<sup>40</sup> Measure belongs to *c*'.

<sup>41</sup> Measure has been taken from the first chromatic key to the left of the instrument, namely, *F*#/*D*.

<sup>42</sup> Measured at the top of the block.

<sup>43</sup> The compass in which all the six surviving pieces would fit is *c-e''*. All chromatic notes between *f*#-*e* flat'' are called for. See Willi Apel, ed., *Keyboard Music of the Fourteenth & Fifteenth Centuries*, vol. 1 (American Institute of Musicology, 1963), 1–9.



the surviving pieces point to the probable use of an instrument with a different keyboard design and, probably, of smaller dimensions.<sup>44</sup> In any case, one cannot disregard the possibility that particularly skilful performers might have been able to attain exceptional playing skills for the performance of chromatic music on the type of keyboard found in the Norrlanda organ.

For sure, the wish to have close-spaced finger-sized keys resulted from the production of small organs that were easy to transport, rather than a player's finger-dexterity aim as such.<sup>45</sup> Nevertheless, the possible advantages for the performance of more elaborated chromatic music offered by keyboards possessing such characteristics were also probably among the reasons for which larger organs might have been provided with the new keyboard design. As I will attempt to demonstrate below, the instrument that might have inspired some of these changes was the early clavichord.

### **Some considerations on the origin of the intersected-keys keyboard**

In his 1511 *Musica getutscht* Sebastian Virdung discusses some aspects of the clavichord, briefly describing how this instrument could have been a result of specific modifications carried out on the monochord. Accompanying his explanation there is a woodcut depicting a keyboard composed of 20 diatonic keys and two chromatic ones. These last—each corresponding to a *b* flat—clearly distinguish themselves from the diatonic keys by being shorter, slightly narrower and by having a black colour. Since the keyboard is depicted as if viewed from above it is not possible to determine if the black keys are separated (i.e. being completely detached and at a higher vertical level) from the diatonic row, although this might well not be the case since the application of colour would suggest this was to serve to help to easily differentiate the chromatic key amidst the diatonic ones. In his discussion, Virdung emphasises that one of the aspects distinguishing both the monochord and

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<sup>44</sup> Christopher Page suggests that a 'portable instrument to which organists could transfer their keyboard technique' was required. Page reckons the psaltery as one of the possible choices. See Christopher Page, "In the Direction of the Beginning," in *The Historical Harpsichord: A Monograph Series in Honor of Frank Hubbard*, ed. Howard Schott (Stuyvesant, NY: Pendragon Press, 1984), 123.

<sup>45</sup> Williams, *The Organ in Western Culture, 750-1250*, 340.

the clavichord is the fact that the latter has more than one string. The reason for this is that ‘on one string alone no consonances can be made to sound *simul et semel*, that is, with each other at the same time [...]’.<sup>46</sup> Virdung does not discuss the instrument’s construction since this ‘has more to do with architecture or the craft of the wood worker than it has to do with Music’.<sup>47</sup> Consequently, he does not offer details about the building of the keyboard of this instrument. Following this woodcut there is another one in which five chromatic keys per octave are present. Apart from the slightly longer diatonic key lever the keyboard looks indeed very similar to that presented in the previous design. This suggests that Virdung might have considered the two *b* flats in the early keyboard as embedded among the diatonic keys—just in the same form as the chromatic keys were in the latter one. What appears from this comparison is that, tacitly, Virdung takes it for granted that both diatonic and chromatic levers were also at the same horizontal level in the keyed chromatic monochord, and that the shorter and narrower chromatic keys needed also to be provided with the distinctive black block which would raise their final horizontal level.

The evidence thus suggests that Virdung had no first-hand evidence as to the aspect of the earliest keyboards. For this reason, he did not know that when the chromatic keys began to appear the *b* flat was to be found among the diatonic ones. A bas-relief of a small portative organ found in the church of St Maria Antica, in Verona, Italy, clearly shows the presence of a single row in which both *b* flat and *b* natural were probably to be found (see plate 1.3).<sup>48</sup>

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<sup>46</sup> Sebastian Virdung, *Musica Getutscht: A Treatise on Musical Instruments (1511)*, ed. and trans. Beth Bullard (Cambridge: Cambridge University Press, 1993), 124.

<sup>47</sup> Ibid. 123.

<sup>48</sup> The image is found in Paola Dessì, “Organi, Orologi E Automi Musicali: Oggetti Sonori per Il Potere,” *Acta Musicologica* 82, no. 1 (2010): 38. I am grateful to Dr Dessì who kindly agreed to send me a high resolution copy of this image.



**Plate 1.3 Organ bas-relief in the church of St Maria Antica, Verona, Italy; end of the fourteenth century (photo: Giancarlo Dessi)**

Two other significant instances in which it is possible to observe the *b* flat key among the diatonic keys are the fragment of an organ board discussed above, and the Norrlanda organ. In both cases one can establish confidently the presence of a *b* flat: in the first instance, among the letters inscribed in the board label (in addition to this fact, there is no cut in the board where the *b* flat key lever would allegedly need to be found if this would have belonged to the upper row of keys); in the case of the Norrlanda organ, the *b* flat key is amidst the diatonic keys, the presence of only four chromatic keys per octave confirming visually its inclusion in the lower row.<sup>49</sup> In spite of Virdung's likely misconception as to the most probable sequence in which chromatic keys might have gradually appeared, his woodcut offers an excellent example of how some of the early manifestations of the clavichord, or keyed polychord, might have looked to an observer.<sup>50</sup> And it is this early keyboard, with its

<sup>49</sup> An organ displaying two rows of keys is included in the early fifteenth-century *Scenes from the life of the Virgin* (Koninklijke Musea voor Schone Kunsten, Brussels, inv. 999). In this depiction the upper row appears to have groups of two keys, something which will suggest that the *b* flat key was to be found among those in the lower row. See Maarten Albert Vente Flor Peeters, *The Organ and Its Music in the Netherlands* (Antwerp: Mercatorfonds, 1971), 40.

<sup>50</sup> A drawing reconstructing the keyed monochord described by Conrad von Zabern in his *Novellus musicae tractatus* shows that this instrument has also twenty diatonic keys and two *b* flat ones. For a

balanced action and block chromatic keys in a close playing-surface level relation to the diatonic ones, the one that might have slowly gained the attention of the practical musician.<sup>51</sup>

The clavichord's earliest documented mention,<sup>52</sup> dating from 1404, is found in the *Minne Regel* by Eberhard Cersne.<sup>53</sup> Its presence in a verse next to instruments such as the *schachbret*, the *monocordium*, the *psalterium*, the *harffe*, the *portatiff*, the *lyra* and the *clauicymbalum* suggests the instrument belonged, probably already for some time, to the contemporary imaginary of musical instruments. One should perhaps ponder the reasons behind the presence of the clavichord in a source listing a number of instruments with a traditional and long established role in the practical-musician's performing life. But to try to figure out the causes which led musicians to take over an instrument originally belonging to the sphere of *musica theoretica*, being probably seen as a monochord with keys,<sup>54</sup> and that probably remained still useful within this realm of music for some time,<sup>55</sup> would by far exceed the scope of this discussion. One might nonetheless be tempted to suggest that its appeal to some musicians of the

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drawing and a photo of a reconstruction of this instrument, see Karl-Werner Gumpel, "Das Tastenmonochord Conrads Von Zabern," *Archiv Für Musikwissenschaft* 12, no. 2 (1955): 144–145. Although at present no historical evidence on the existence of this instrument before von Zabern's reconstruction is known, the presence of a system in which keys were adapted to the task of obtaining a tone from single, or multiple, strings by means of a tangent cannot be discarded. See Nelly van Ree Bernard, "The Keyed Monochord," in *De Clavicordio I: Proceedings of the International Clavichord Symposium, Magnano 1993*, ed. Bernard Brauchli, Susan Brauchli, and Alberto Galazzo (Istituto per i beni musicali in Piemonte, 1994), 21–27, especially 23–24. Van Ree Bernard does not consider the possibility that the *b* flat was to be found among the diatonic row keys.

<sup>51</sup> One can perhaps only speculate as to how an awareness of the usefulness of the clavichord for the practical musician arose. A contact between musicians and physicians and astrologers during the fourteenth century might have brought to the attention of the organists the existence of a keyed string instrument such as a keyed monochord. For a view of the origin of the clavichord within the circle of the astrologers and physicians, see Bowles, "On the Origin of the Keyboard Mechanism in the Late Middle Ages."

<sup>52</sup> Another way to assert the presence of the clavichord during the preceding century could start from a consideration of the various alternative denominations for the instrument. Names such as *monochordium* (e.g. Johannes de Muris), *monacordo* (e.g. Donato da Cascia) or *menacordo* (e.g. Simone Prudenanzi) seem to have been in use. See Alfons Huber, "Konstruktionsprinzipien in Clavichordbau. Überlegungen Zu Mensurierung, Stimmtonhöhe Und Besaitung Bei Clavichorden Des 15.–18. Jahrhunderts," in *Musik Muss Man Machen, Eine Festgabe Für Josef Mertin*, ed. Michael Nagy and Josef Mertin (Vienna: Vom Pasqualatihaus, 1994), 241; and Renato Meucci, "S'I' Monacordo Gentile Stormento, The Terminology of the Clavichord in Italy," in *De Clavicordio I: Proceedings of the International Clavichord Symposium, Magnano 1993*, ed. Bernard Brauchli, Susan Brauchli, and Alberto Galazzo (Istituto per i beni musicali in Piemonte, 1994), 57–58.

<sup>53</sup> For a transcription of the verses in which the clavichord appears, see Brauchli, *The Clavichord*, 301, note 28.

<sup>54</sup> Huber, "Konstruktionsprinzipien in Clavichordbau," 249 and 276.

<sup>55</sup> See Nicolas Meeùs, "The Chekker," *Organ Year Book* 16 (1985): 16.

period might have been rooted in the instrument's inherent possession of some contemporary sought-after qualities on musical instruments (e.g. portability, straightforward tuning, and easy note production). Parallel to this idea, I will suggest that some issues which might also have played a determinant role in the consideration of the early clavichord as a performing instrument were its simple building process and the size of its keyboard.

The early clavichord may have begun to take a role in practical music during the playing of music in which any of the various types of organs of the time were not available, although combined performances might also have taken place. The suggestion that the checker might have been, at least in some instances, an early kind of clavichord, could help to shed some light upon part of the early clavichord's seemingly undocumented history as a practical-music instrument.<sup>56</sup> Let us briefly discuss some historical sources. In 1415 the Crown Prince of Aragon (1396–1458), later Alfonso I, wrote a letter to an unknown person which includes what is apparently the last known mention to the checker (referred as *squaquer* or *scaquer*) among the records belonging to the court of Aragon. The contents of this letter suggest that the prince himself had commissioned both an organ and a *scaquer* from a builder in Valencia. It also contains a princely request: to have his acquaintance's *scaquer* on loan until one of the ordered instruments arrives:

Com nós façem fer en Valencia .I. orgue e .I. squaquer, e atrobem plaer gran en semblant sturment, vos pregam affectuosament que I vostre scaquer nos prestets entretant, car nós, de continent que haüt hajam lo dit orgue o scaquer vos enviarem lo vostre sens alguna falla. Certificant-vos que serà cosa de la qual nos farets plaer e servey que molt vos grahiem. Dada en lo loch de Martorell, sots nostre segell secret, a .IIII. dies de setembre del any .MCCCCXV.

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<sup>56</sup> Nicolas Meeùs has proposed that the early checker was in fact a clavichord. See *ibid.* 20–21. John Koster also considers that early evidence of the existence of the clavichord is available under another naming of the instrument, namely, as the checker (or *échiquier*). See John Koster, “Clavichord and Clavecimbel in Dutch Society, 15th–17th Century,” ed. Francis Knights, *Clavichord International* 12, no. 1 (2008): 25. Christopher Page has suggested that the checker was probably a denomination used to describe a variety of instruments. Two sources served him to propose the existence of at least two families of checkers: in the early fifteenth century, Jean de Gerson identifies the checker as a stringed keyboard instrument; on the other hand, in a late fifteenth-century source (1485) the term checker appears to refer to a type of organ (*les petites orgues dit exchaquiers*—the little organs called checkers). See Page, “In the Direction of the Beginning,” 113.

As we are having built an organ and an *exaquier* in Valencia, and as we take much pleasure in such an instrument, we ask you affectionately to lend us your *exaquier* in the mean-time, for as soon as we have received our own above-mentioned organ or *exaquier*, we shall send you yours without delay. We assure you that this matter will give us pleasure and be a service for which we shall be most grateful. From Martorell, under our secret seal, 4 September, 1415.<sup>57</sup>

One particular section of this letter appears to provide evidence of a particular relation between the organ and the checker: the statement '[...] as soon as we have received our own above-mentioned organ or *exaquier*, we shall send you yours without delay' suggests there is a possibility for the performer to play the same music either on one or on the other instrument,<sup>58</sup> thus pointing to a performance practice interchangeability of both instruments.<sup>59</sup> In other words, the borrowed *scaquer* was to make up for the absence of any of the new instruments, i.e. an organ or a *scaquer*. If this would have been the case at least two organological elements might have been similar on both instruments, namely, the keyboard design and its compass.<sup>60</sup> This interpretation may perhaps not be exempt of the charge of having misread particularly unclear passages of the above quoted text.<sup>61</sup> To be sure, if one reappraises this letter based on the information supplied by another source, although a much later one, one might conclude that the *scaquer* was in fact an organ.<sup>62</sup>

<sup>57</sup> Archivo de la Corona de Aragón, Reg. 2452, f. 79. The translation is taken from Tess Knighton, "Another Chekker Reference," *Early Music* 8, no. 3 (1980): 375.

<sup>58</sup> This, despite the possible differences in pitch between the organ and the checker: one could have had a tenor register and the other a treble one. See David Kinsela, "A Taxonomy of the Renaissance Keyboard Compass," *The Galpin Society Journal* 54 (2001): 356–357; and David Kinsela, "The Capture of the Chekker," *The Galpin Society Journal* 51 (1998): 85.

<sup>59</sup> Reinhardt Strohm has proposed that the music contained in the Robertsbridge manuscript could be performed either on the chamber organ or the exchiquier. See Reinhard Strohm, *The Rise of European Music, 1380-1500* (Cambridge; New York: Cambridge University Press, 1993), 84. Kimberly Marshall has also pointed out, under the assumption that the chekker was a type of stringed keyboard instrument, that '[t]he juxtaposition of small organ and chekker implies that a similar technique was used for both instruments [...]'. See Kimberly Marshall, "The Organ in 14th-Century Spain," *Early Music* 20, no. 4 (1992): 550.

<sup>60</sup> The new organ and chekker, however, might not have possessed the same pitch.

<sup>61</sup> Based on the phrasing of this letter, Tess Knighton has suggested that the term chekker might be a generic one for all keyboard instruments. See Knighton, "Another Chekker Reference," 375. The statement 'as we take much pleasure in such an instrument' could in fact point to a generic reference i.e. a keyboard instrument. The reading of the source is problematic, particularly at one point: the *o* in '*dit orgue o scaquer*' could also indicate that the prince is speaking of only one instrument having two possible denominations. Thus, the letter would be referring to a characteristic type of organ for which nothing more than an analogue name is known. But see also below, note 64, for another source which could help to support the thesis that the letter is in fact speaking of an organ *and* a *scaquer*. I am grateful to Prof. José Enrique Gargallo, from the Department of Romanic Philology at the University of Barcelona, for his assistance in the interpretation of the original text.

<sup>62</sup> '*les petites orgues dit exchaquiers*' (the little organs called chekkers). See also above, note 56.

However, a letter from the year 1388 might support the idea that the *scaquer* was indeed a different instrument. In this document, stemming from the same court, the presence of a Johan dels orguens, a player of the *exaquier* and the small organs, is requested.<sup>63</sup> Moreover, the letter asks its addressee to remind the named musician to bring with him the music manuscript where he had annotated the *estempides* and the other works which he is able to play on the *exaquier* and the organ. This distinction is strengthened by another letter of King John of Aragon, written four years later, in which the instruments his court had at hand are enumerated: ‘orguens de coll, harpa, exaquier, rota, orguens de peu [...]’.<sup>64</sup> This list strongly suggests that, at this court, the *exaquier* was not an organ. Hence, this source appears to support the argument that the writer of the two documents mentioned above was in fact speaking of two different instruments. If this is the case, organists could indeed have been the first clavichordists.<sup>65</sup>

The last consideration might help us to describe an important set of issues which could have been determinant in the conformation of the physico-mechanical approaches, such as those found in the realm of fingering, used by musicians when performing on keyboard instruments. The departure point in an attempt to describe and evaluate the impact of these issues will be the consideration that during the second half of the fourteenth century performers could have dealt with diverse manifestations of the keyboard, such as the two-row, or the intersected-keys type. In the latter design the key levers of both diatonic and chromatic keys are positioned at the same horizontal level and, due to this circumstance, the shorter chromatic-key lever occupies the space cut in between two consecutive diatonic keys. The first type is found in organs such as the Norrlanda instrument; the second was most probably present on some early clavichords incorporating chromatic keys shorter than those in the diatonic row, perhaps in an attempt to resemble the shorter chromatic key in

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<sup>63</sup> Letter of King John I of Aragon to Viscount de Roda, quoted in Edwin M. Ripin, “Towards an Identification of the Chekker,” *The Galpin Society Journal* 28 (1975): 17, no. 9. In the same article, item no. 8 speaks of the same performer, referring to him at some point as one able to play ‘exaquier [e] los petits orguens’. The musician in question is perhaps Jean (Johan) Visée. See Koster, “Clavichord and Clavecimbel in Dutch Society,” 27.

<sup>64</sup> In a letter of King John of Aragon from 1394. See Ripin, “Towards and Identification of the Chekker,” item no. 11.

<sup>65</sup> This has already been suggested by John Koster. See Koster, “Clavichord and Clavecimbel in Dutch Society,” 26.

Norrlanda type keyboards. The continuous contact with coexisting variants of the keyboard design might have encouraged some performers to pursue a gradual homogenization of the keyboard medium. The gradual inclusion of smaller and less separated organ keys seems to confirm this tendency. This inclusion appears to indicate that some of the organological characteristics of a keyboard design could have been altered as a consequence of the playing advantages found on another keyboard design. In this respect, there is one particular historical inflexion point suggesting that the keyboard of the clavichord gained the favour of performers over the two-row organ keyboard designs, namely, the adoption by the organ of the intersected-key keyboard design. The clearest available evidence of this process is perhaps that found in an altarpiece preserved in the city of Ghent.

### The Ghent altarpiece

Saint Bavo Cathedral in Ghent houses the remains of one of the most remarkable artisanal works from the fifteenth century: the painted panels of the van Eyck brothers' altarpiece.<sup>66</sup> The reading of a battered inscription referring to the authorship of the original work, a poem included in the frame of the painted panels, has proven to be extremely controversial. According to a reconstruction of some worn-out elements of the inscription, the creators of the original altar were one sculptor whose name has not yet been identified, possibly Hubertus or Rupertus, and a painter, Jacob van Eyck.<sup>67</sup> It has also been suggested that Jan van Eyck alone conceived the design of the entire work, which consisted in the unit of a sculptured stone framework and the painted panels. The realization of the first element was commissioned from

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<sup>66</sup> In the extensive literature on the altarpiece, the discussion on the authorship problems is often complex and scholars are divided as to the precise contribution of Jan and Hubert van Eyck (this without speaking of those who claim Hubert never existed). For aspects concerning the following discussion on the organ included in one of the panels I rely often in Lotte Brand Philip, *The Ghent Altarpiece and the Art of Jan van Eyck* (Princeton N.J.: Princeton University Press, 1971). In this excellent book, ignored in some discussions about the authorship of the altarpiece, the author proposes a carefully elaborated reconstruction of the original condition of the altar while discussing the cultural implications of the original appearance of the work. Philip attributes the complete design of the altar and the painted panels to Jan van Eyck. See also Volker Herzner, *Jan Van Eyck Und Der Genter Altar* (Worms: Wernersche Verlagsgesellschaft, 1995), 9–17. Maurice B. McNamee provides a brief but substantial summary of an important part of the literature discussing the origin of the altarpiece. See Maurice McNamee, *Vested Angels: Eucharistic Allusions in Early Netherlandish Paintings* (Leuven: Peeters, 1998), 87–88.

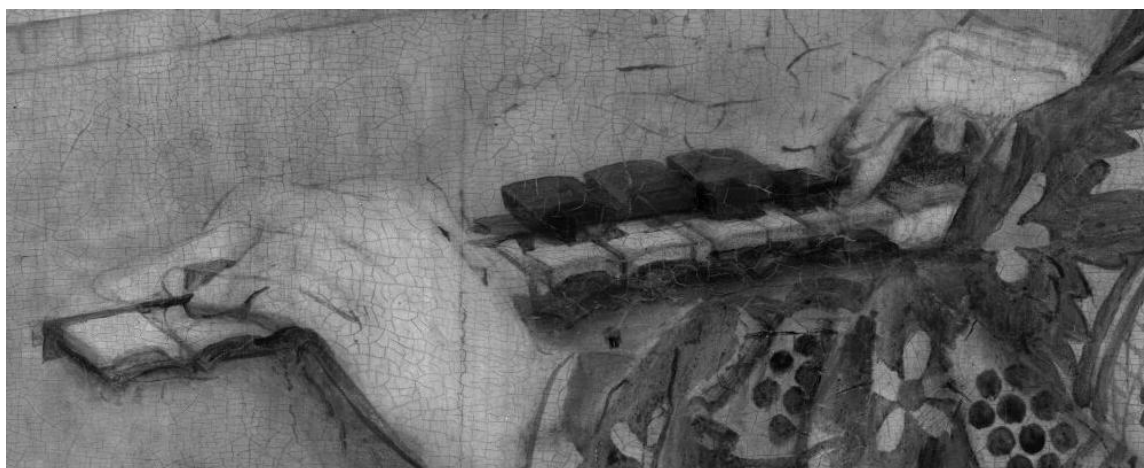
<sup>67</sup> Philip, *The Ghent Altarpiece*, 44–50.



Hubertus; the paintings, closely related to the non-painted elements such as columns and the predella,<sup>68</sup> were to be elaborated by Jan van Eyck himself.

Infrared photographs of the panels helped to reveal that Jan van Eyck corrected the paintings in several spots.<sup>69</sup> One of these so-called *pentimenti* is found in the panel where a group of musicians are depicted together with various instruments. Among these last there is a large gallery organ. The photographs show that both the left hand of the organist and the keyboard were altered at some point not later than 1432, the year of the dedication of the altarpiece.

More recent infrared macrophotography and reflectography, and X-radiography images photographs have helped to confirm that the original keyboard design was constituted by two separated rows of keys in a disposition similar to that observed in the Norrlanda organ (see plates 1.4 and 1.5).<sup>70</sup>

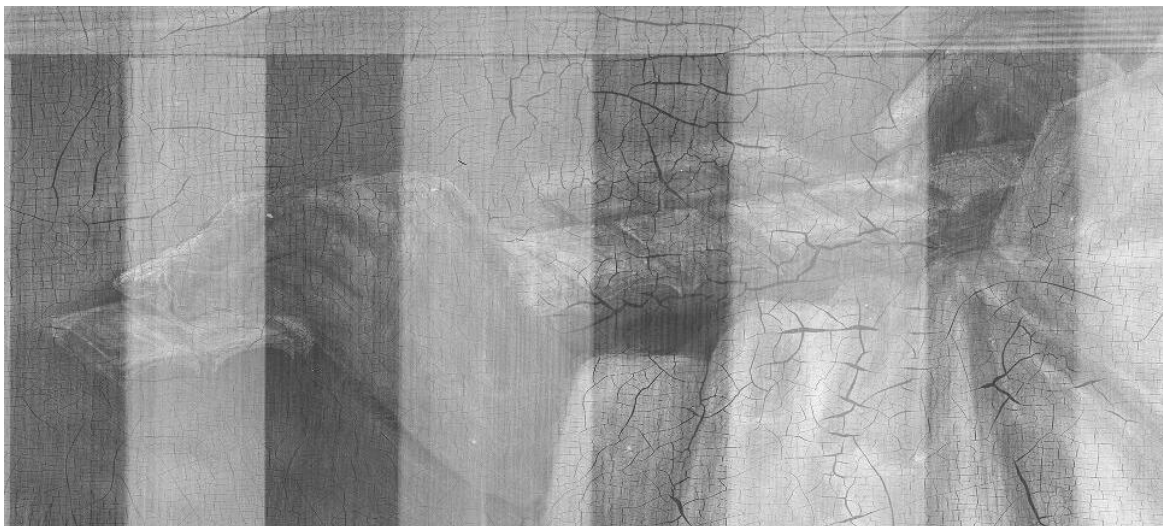


**Plate 1.4 Jan van Eyck, Ghent altarpiece, detail, infrared reflectography, *Closer to Van Eyck: rediscovering the Ghent Altarpiece*, by permission**

<sup>68</sup> The flow from the fountain in the *Adoration of the Lamb* is abruptly cut in the lower end of the panel. It seems it was intended to *flow* into the predella. Compare with Petrus Christus', van Eyck's pupil, *The Fountain of Life*. See *ibid.* 66.

<sup>69</sup> On the *pentimenti*, see *ibid.* 53. The particular case of the organ *pentimenti* was originally discussed in Ripin, "The Norrlanda Organ and the Ghent Altarpiece." Some infrared photographs are contained in this article.

<sup>70</sup> The photographs using the technologies above mentioned have been produced by an interdisciplinary research project. See Lasting Support, "Closer to Van Eyck: Rediscovering the Ghent Altarpiece," 2011, <<http://clostertovaneyck.kikirpa.be/#intro>>. For a brief analysis of these photos, see appendix 1.



**Plate 1.5 Jan van Eyck, Ghent altarpiece, detail, X-radiography, *Closer to Van Eyck: rediscovering the Ghent Altarpiece*, by permission**

The intention of the repainting was to have the upper row of chromatic keys displaced to a level at which the surface of the diatonic keys would join the level of the undersurface of the chromatic ones. Although the specific reasons that took Jan van Eyck to repaint the keyboard are unclear, it might be safe to state that the ultimate depiction reflects leading-edge organ keyboard design trends.<sup>71</sup> In other words, through the repainting process the keyboard was taken to resemble a keyboard design most probably already found on contemporary harpsichords and clavichords. Thus, the organ keyboard could have been modified in an attempt to modernise the instrument, probably as a response to other keyboard designs van Eyck might have encountered in the regions he visited during the years in which he worked on the altarpiece.<sup>72</sup> It is also possible that he repainted it after the suggestion

<sup>71</sup> The astronomer, physician and clockmaker Henry Arnaut de Zwolle, who was also working at Philip the Good's court, describes in a section of a manuscript document (c.1440) those keyboard instruments known to him (i.e. organ, harpsichord, clavichord and dulce melos). As a part of his contribution to the volume, Arnaut includes a design of the clavichord which uses Pythagorean tuning, thus probably an instrument expressly designed to aid the work of the physician, not that of the practical musician. Conrad von Zabern's *renovatio monocordi*, expresses a desire to reintroduce an instrument that had been used to teach and learn the *ars musica* and the *cantus ecclesiasticus*. Von Zabern's keyed monochord includes elements belonging to the clavichord of his time. See Gümpel, "Das Tastenmonochord Conrads Von Zabern," 146–147; and Kinsela, "The Capture of the Chekker," 71–72. On temperament, see James Murray Barbour, *Tuning and Temperament: A Historical Survey* (Mineola, New York: Dover Publications, 2004), 3. On the relation of physicians to musical instruments, see Bowles, "On the Origin of the Keyboard Mechanism," 161.

<sup>72</sup> Van Eyck modified, among other things, the vegetation present in the *Adoration of the lamb*. The inclusion of Mediterranean vegetation might reflect his contact with this flora during his trips to Italy. It is there that he might have also encountered keyboard designs which could have influenced the

of a musician, perhaps one of van Eyck's colleagues at the court of Philip the Good.<sup>73</sup>

The reasons behind this *pentimento* are not entirely clear. One among them could be the need to include a possible symbolism.<sup>74</sup> It may be a reference to the Old Heaven which has been replaced by the New Heaven. It has been suggested that the whole upper section of the panels is a representation of the New Heaven, the lower section being the New Earth, as referred in Revelation 21. The whole altarpiece, including the stone framework, could then be considered a representation of the Heavenly Jerusalem, the same idea lying behind the earthly-church building. Their painted and sculptured elements are therefore imbued by the idea of timelessness,<sup>75</sup> being, according to the Middle Ages conception, an 'ultimate meaning of the present state'.<sup>76</sup> I suggest that the fact that van Eyck repainted the keyboard including a more 'modern' design might be related to this idea of timelessness: perhaps for van Eyck, the new keyboard design was to better reflect the eternal character of the altar.<sup>77</sup> In any case, his use of a keyboard design common to the clavichord and the harpsichord may be seen as a reflection of the expansion in the use of stringed keyboard instruments for performance.

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repainting of his organ. On the repainting of the vegetation, see Bernhard Ridderbos, Anne Van Buren, and Henk van Veen, eds., *Early Netherlandish Paintings: Rediscovery, Reception, And Research* (Los Angeles, CA: Getty Publications, 2005), 56.

<sup>73</sup> Perhaps Binchois, for which van Eyck might have realized a portrait finished in the same year as the Ghent altarpiece. For information on the portrait, see David Fallows, "Binchois, Gilles De Bins Dit," *Grove Music Online* (Oxford University Press, 2012).

<sup>74</sup> See also note 77.

<sup>75</sup> See Philip, *The Ghent Altarpiece*, 55 ff., especially 56–57.

<sup>76</sup> Ibid. 57, note 110.

<sup>77</sup> If we consider the authorship proposed by Philip, the depicted organ could have been designed, painted and altered solely by Jan van Eyck. The instrument's design might also have been van Eyck's own for which he may have used elements belonging to real instruments. Therefore, and as has been often observed, it is preferable not to take it as a depiction of a real instrument. On organological problems posed by the design of this organ, see Ripin, "The Norrlanda Organ and the Ghent Altarpiece"; and Williams, *A New History of the Organ from the Greeks to the Present Day*, 56–58. One of the prevalent ideas among some scholars concerning the authorship of the painted panels is that Hubert van Eyck might have begun them. Hubert's death in 1426 would have caused Jan van Eyck, supposedly his brother, to finish the work. He, most probably, was the one who repainted the keyboard. If Hubert (born c.1370) painted or designed the original keyboard, he might have used a design prevalent in the last part of the fourteenth century. On the other hand, if Jan van Eyck (born c.1390) was the original designer, the initially depicted keyboard might represent a design still prevalent, at least in some instruments, during the earlier years of the fifteenth century. This situation seems to be confirmed by the organ depicted in the early fifteenth-century *Scenes from the life of the Virgin*. See Flor Peeters, *The Organ and Its Music in the Netherlands*, 40.

The second version of the keyboard depicted in the Ghent altarpiece is clearly constituted by intersected-key levers, as only through this type of lever arrangement would it be possible to activate the chromatic key without it being obstructed by the diatonic key's surface. In this type of keyboard the diatonic-key surface does not anymore have a rectangular shape since its surface has to be cut at the back. As a consequence of this change the diatonic key shape will now be made up of two sections: front and tail. The length of the latter is, as can be appreciated in both Virdung's woodcuts and the Ghent altarpiece, equivalent to that of the chromatic key.

All in all, the evidence found in the altarpiece suggests that some of the conjectures advanced above might be plausible. First, the appearance of chromatic keys on stringed keyboard instruments was most probably been prompted by the presence of chromatic keys on the organ. It is not clear, however, how the process unfolded that saw the introduction of short, block-raised chromatic key levers on the early clavichord. Second, the clavichord's advantages immediately obvious to the players—such as the absence of bellows and the small size of the keyboard, and which might have facilitated the use of chromatic keys and the transportation of the instrument—seem to have incited them to practise and perform regularly on this instrument. Slowly the theoretical instrument began to be approached as a practical one.<sup>78</sup> Added to this, the playing advantages offered by the intersected-keys design might have induced organ performers and builders to embrace this keyboard and seek its adoption by the organ.<sup>79</sup> The verses in the *Minne Regel* appear to substantiate this view.

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<sup>78</sup> Another organological element which reveals the close relationship between the organ and the clavichord is the presence in the earliest representations of the clavichord of a protruding keyboard lacking both cheeks and keywell. See Edwin M. Ripin, "The Early Clavichord," *The Musical Quarterly* 53, no. 4 (1967): 520. For images of fifteenth century clavichords see *ibid.* plates 1 and 2; and Brauchli, *The Clavichord*, plates 2.1–2.3 and 2.7–2.11.

<sup>79</sup> And, most probably, not the other way around. The organ, as an instrument belonging to the realm of *musica practica*, would have required the extra chromatic notes to facilitate the transposition of melodies.

## Tradition

The introduction of intersected keys in the keyboard of the Ghent altarpiece organ required another repainting to be made, namely, that of the left-hand fingers of the organist. This was as a result of the block keys now occupying part of the rear section of the diatonic plate. Thus, the previously extended fingers needed to be retracted due to the sudden lack of space.

When van Eyck introduced these changes he also, most strikingly, modified the original angle of the keys—that formed by the surface of the natural plate and the board from which the keys protrude—and reduced drastically the length of the natural key. Thus, in the *pentimento* the fingers give the impression of being placed close to the front edge as a result of the very short length of the new diatonic key. Despite the apparent imbalance in the relation of the hand to the keyboard resulting from all these modifications, the rest of the hand seems not to have suffered any modification. This situation would complicate at this point an interpretation of the present image.<sup>80</sup> Further research will be needed that could help to determine if this image can shed some light upon the possible tendency of some organists to adapt those playing practices used in the two-row keyboard to those instruments provided with the new keyboard design, rather than to search for other approaches.<sup>81</sup> If one considers that the repainting might have obeyed van Eyck's wish to depict a compelling image of a hand in the act of performance—aiming to cause in his viewers an impression capable of transporting them to Heaven through the aid of his realistic rendering—one could assume that this representation is an attempt to provide a veritable portrayal of a playing technique used by musicians of the period. Contemporary representations of clavichord and organ playing corroborate van

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<sup>80</sup> The new size of the front section of the diatonic key might not reflect the condition found in other contemporary keyboards with a similar design. An enlargement of the diatonic keys might have entailed repainting parts of the left hand and the right thumb, a task van Eyck might have found too troublesome. The proportions found on real instruments might have been closer to those found in the keyboard depictions found in Arnaut de Zwolle's manuscript.

<sup>81</sup> By the time in which the Ghent altarpiece was conceived some representations of the two-row keyboard (see below, note 82) suggest that performers were already playing the organ situating the wrist at a higher level. However, the presence of the low wrist in other depictions suggests that the low wrist approach might have preceded the use of the wrist at a higher level. For a discussion on some of the representations showing the low wrist approach, see chapter 2, pp. 49–62.

Eyck's depiction of playing technique.<sup>82</sup> However, given the problems posed by the image, it cannot at this point support the idea that some performers might have adopted immediately distinctive approaches to the new keyboard design.

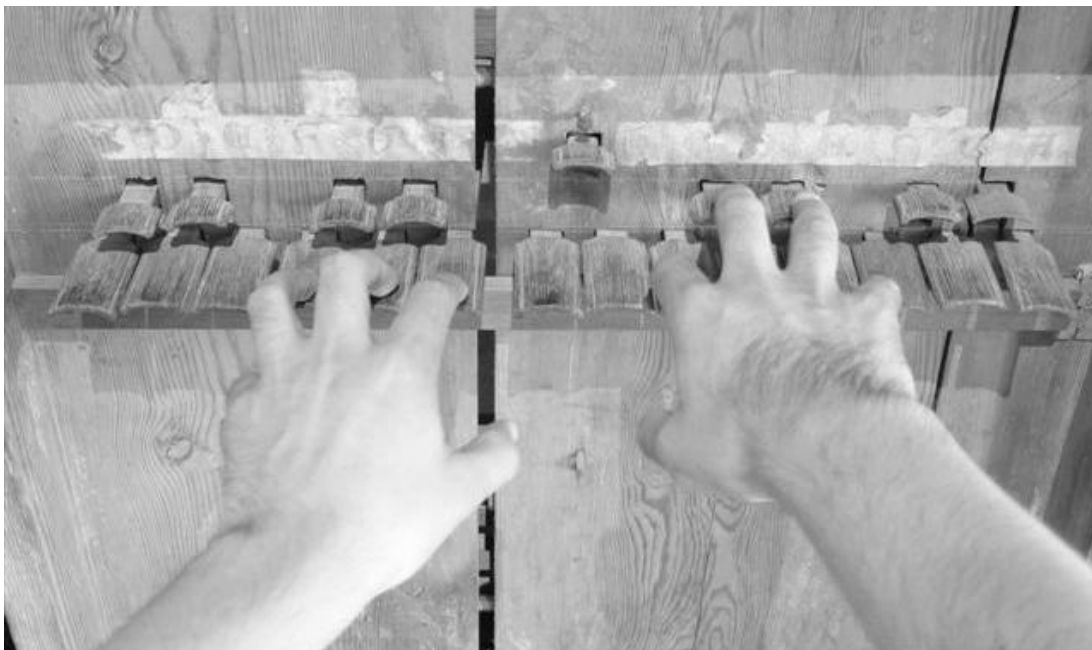
The raised keys on the two-row keyboard might have allowed performers to use the surface of the diatonic key in various forms. This becomes particularly clear when one approaches the Norrlanda organ keyboard where one is immediately aware that the width of the key plate played an important role in the way in which fingers were to be used. As can be seen in plates 1.6 and 1.7, the lateral extensions required to play on this keyboard do not facilitate the use of fingers in sequence (e.g. 2–3–4–5). Although one could argue convincingly that sufficient practice would have allowed a performer to comfortably play on this type of keyboard using more than two consecutive fingers, other evidence points to a different direction.<sup>83</sup> After direct contact with this keyboard, and a review of the iconography, I suggest that the fingers might have been used in a manner which, although also applied to smaller keyboards in later centuries, was perhaps more attuned and might have facilitated playing on larger sized keyboards. This manner is the crossing of the fingers.<sup>84</sup>

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<sup>82</sup> See Edmund A. Bowles, "A Preliminary Checklist of Fifteenth-Century Representations of Organs in Paintings and Manuscript Illuminations," *Organ Yearbook* 13 (1982): images nos. 4, 6 and 24; and Edmund A. Bowles, "A Checklist of Fifteenth-Century Representations of Stringed Keyboard Instruments," in *Keyboard Instruments, Studies in Keyboard Organology, 1500–1800*, ed. Edwin M. Ripin (New York: Dover Publications, 1977), images 5, 6, 10a, 10b and 13.

<sup>83</sup> See appendix 1.

<sup>84</sup> This argument arises from a consideration of the measurements of the Norrlanda organ's keyboard and the evidence found in iconography. However, it might not reflect the actual form in which performers approached the instrument itself. For a hypothesis on this issue, based on wear evidence found in the keyboard of this instrument, see appendix 1.



**Plate 1.6 Possible disposition of the fingers at the keyboard of the Norrlanda organ**



**Plate 1.7 Appearance of the hand when fingers 2, 3, 4, and 5 are placed above the keys**

When paired fingerings<sup>85</sup> are used for the first time in a keyboard of similar dimensions to those present in the Norrlanda organ, one will slowly start to realise the effortlessness with which the type of mechanical movement involved by these fingerings is accomplished in this medium. The reason lies partly in the fact that by using only two fingers (e.g. 3–2–3–2 descending in the right hand, 3–4–3–4 ascending) one would avoid using three long fingers in a sequence of three consecutive keys. This is desirable since the greater the distance between the tips of the long fingers in a horizontal plane, the most wearisome the position becomes. Thus when one uses only one pair of consecutive long fingers no tension grows in the knuckles (i.e. the metacarpophalangeal joints) unless the separation is very large. Paired fingerings were then probably to have their best effect, and also possibly their origin, in instruments where the distance between the keys was close to that defined by the separation between the pipes, the width of the keys being in some cases probably much larger than that existing in the Norrlanda organ.<sup>86</sup>

Paired fingerings might also have been in currency in instruments with buttons, but it is in the positive organs where these fingerings might have become particularly necessary. The use of a lateral-playing position in small portative organs, where performers often appear to have been required to play with the right hand and activate the bellows with the left, is already found in late thirteenth-century iconography.<sup>87</sup> Larger positives appear to have also been played in this form on some occasions. But when this instrument grew to a size far too large for a player to both activate the bellows and play the keys in a comfortable manner, two sets of paired

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<sup>85</sup> That is to say, those constituted by a sequence of two consecutive fingers playing conjunct passage work.

<sup>86</sup> For an analysis of this technique, based on the experience of playing on a contemporary musical instrument including a number of characteristics probably found in historical pre-Norrlanda organs, see appendix 2.

<sup>87</sup> In an image of a portative organ contained in the Beupré Antiphonary (Flanders, 1290), the angel's fingers, once one has considered the distortion of the perspective in this depiction, appear to be placed parallel to the length of the keyboard. The image can be seen in Kimberly Marshall, *Iconographical Evidence for the Late-medieval Organ in French, Flemish, and English Manuscripts*, vol. 2 (New York; London: Garland Pub., 1989), plate 56; and Marshall, "The Organ in 14th-Century Spain," 552.



fingerings might have come temporarily to the aid of the player: 3–4–3–4 ascending, 2–1–2–1 descending.<sup>88</sup>

It is important to emphasise that in the two cases just described, paired fingerings appear to have been called for as a response to the conditions imposed by both the size of the instrument and its components, and its entailed mechanical requirements. Of course, one could argue that a fingering system may be behind the design of a particular keyboard topology. However, the coexistence at some point in the early fifteenth-century of small- and large-sized keyboards and the evidence of the use on the latter of single fingers suggest that this was not the case with paired fingerings. The use of these fingerings seems to have arisen from a need to play increasingly longer ascending or descending scales at a pace which made the use of single fingers inadequate for the task. While paired fingerings might have proved very useful in this particular playing situation when playing on small positives, they were probably indispensable on keyboards displaying larger keys. In any case, it is not clear why they were to be preserved once the keyboard design adopted smaller, and closer-spaced, keys. Moreover, paired fingerings were retained after performers switched to a playing position which not only allowed them to perform with both hands, but that also naturally aligned the fingers with respect to the key lever. I suggest that one of the reasons which might have favoured the continuity in the use of paired fingerings has to do with a repertoire performed primarily within the tonal region of the later so-called easy keys. In addition to this, a regular approach to the music in these keys through the use of paired fingerings—due to the instrument's requirements and the facility allowed by a single-level row of diatonic keys—might have had as a consequence a prevalent acceptance of these as being the basis of the fingering system.

At some point, performers might have been impelled to develop specialized and ingenious physical approaches to the keyboard as a result of a more frequent use of the chromatic keys due to transposition requirements of singers; the growing size of a

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<sup>88</sup> An example of this situation is found also in the *Beaupré Antiphonary*. An image showing a positive organ suggests that the player of this instrument would be unable to activate the discant keys unless he leaves the bellows at some point. The image is found in Marshall, *Iconographical Evidence*, Vol. 2, plate 57, and Marshall, "The Organ in 14th-Century Spain," 553.

repertoire specifically composed in the difficult tonalities; the appearance of music which departed from literal vocal imitation; and the introduction of a variety of polyphonic textures. However despite the certainly substantial impact of all these in the requirements of playing technique, fingering remained essentially based on the use of paired fingers well into the eighteenth century.

It is at the middle of the eighteenth century that C.P.E. Bach declares the fingering principles exposed in his treatise, among other basic elements of keyboard playing, were based on ‘nature’.<sup>89</sup> As noted at the beginning of this chapter, Emanuel Bach’s presentation of the fingering principles in the *Versuch* appears to be derived from a thorough understanding of the relationship between the body and the keyboard design, something that seems to be reflected on his statement that ‘to a large extent the shape of an instrument determines its fingering’.<sup>90</sup> It is important to emphasise that although Emanuel Bach alerts his readers about the distinctive qualities of the action of the clavichord, the harpsichord and the fortepiano,<sup>91</sup> he makes no further comment on this issue in the chapter on fingering. The performer’s abilities to interact with the mechanical qualities of each of these keyboard instruments belong to another area of keyboard pedagogy where, nevertheless, fingering principles remain fundamental, namely, performance: ‘A correct use of the fingers has an inseparable relationship to all elements of the manner of playing’.<sup>92</sup> In other words, the physico-mechanical aspect of playing is indissolubly connected to the aims of musical performance. Before this topic is discussed, various other aspects which were to define the mechanical relation between the performer’s body and the instrument will need to be explored.

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<sup>89</sup> Bach, *Versuch*, Ch. 1, Fingering, § 18. See above, note 17.

<sup>90</sup> Bach, *Versuch*, Ch. 1, Fingering, § 1.

<sup>91</sup> In the case of the fortepiano, Emanuel Bach considers that its touch (*Tractirung*) must be carefully scrutinized. Only in this form the player will be in the position to acquire those physical skills necessary to articulate his musical ideas by means of the instrument’s particular action. See *ibid.* § 11. For a discussion on the touch on the fortepiano, see chapter 3, pp. 128–129. For an overview of the implications of the term touch, see Sarah Maria Sargent, “Touch (ii),” *Grove Music Online*. (Oxford University Press, 2012).

<sup>92</sup> Bach, *Versuch*, Ch. 1, Fingering, § 4. My translation.

## 2 Keyboard and keyboard player

A keyboard instrument results from human ingenuity. But ingenuity is also demanded when the instrument is required to fulfil a particular musical aim. The player has then to define a physical approach which would enable him or her to aurally present, by means of the mechanical instrument, a socio-culturally and historically shaped musical meaning. The definition of this approach begins with a consideration of the mechanical characteristics of the instrument—including the physical conditions in which it is to operate—and the performer's own individual biomechanical capacities and limitations. It is from this point that the building of a refined performer's techno-mechanical approach, namely that made up by a socio-culturally shaped physico-mechanical approach, would start.<sup>1</sup> The way in which this techno-mechanical approach is shaped will depend on a variety of circumstances. Among these one would need to consider the contemporary state of music in particular regions and historical periods; the socio-cultural sphere in which the performer lived and worked—and which was to shape his or her body—; and the organological condition of the instrument—which might be modified according to the needs posed by the two preceding conditions.

With the appearance of the keyboard in the medieval organ, specific mechanical demands were introduced that needed to be seized through the specific biomechanical properties of the human body. In particular, distinctive bodily movements to press down the keys were now necessary in order to operate the instrument satisfactorily. It is from this basic mechanical condition that a number of physico-mechanical approaches to the keyboard were to arise. In some cases, the origins of these approaches can be directly traced to the various and contrasting organological characteristics keyboard designs have presented throughout time and the conditions imposed by the spatial positioning of the keyboard. In this chapter I will then review some prominent historical physico-mechanical approaches to the keyboard starting from an attempt to trace back the probable organological and

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<sup>1</sup> For a discussion on the concepts 'physico-mechanical' and 'techno-mechanical', see the introduction, pp. 2–3, and below, note 44.

biomechanical reasons behind their appearance. In order to do this it will be necessary to outline some of their specific mechanical characteristics. It is expected that through this evaluation one could also define, in some measure, the role of the instrument in the shaping of the performer's techno-mechanical approach. Central to this analysis will be the study of the relation between the organ and the clavichord. However, in this discussion I will leave aside the initial stages in the conjunction of the clavichord and the organ and will begin from the historical period in which the keyboards of both instruments came to resemble each other.<sup>2</sup> Specific questions on the effect the use of the clavichord had on organ performance within particular regions and historical periods will have to be addressed in another study.

To the observer a bodily approach can appear as a largely mechanical act.<sup>3</sup> However, as I have mentioned above, this set of corporal movements are socio-culturally nuanced. This means that the way in which the keyboard player's body is used in performance is intrinsically related to the body's motor development within a historical reality. The discussion contained in this chapter includes a description of some playing approaches to the keyboard in largely mechanical terms. This route was taken in an attempt to compare in a more effective manner particular aspects of the physico-mechanical requirements found in a number of historical periods. Thus, while this way of presenting the argument might put the mechanical aspect of playing in the foreground, it is hoped that the discussions in the introduction and chapters 4 and 5 will help to gain a perspective of the place and implications of the mechanical element within the broader concept of a historical bodily approach. Finally, particular attention will be given to the tracing of some aspects that might have defined and shaped J.S. Bach's own bodily approach at the keyboard.

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<sup>2</sup> A probable reshaping of the keyboard of each of these instruments, as a result of various features' transferences, might have taken place in the course of several years. It will not be possible to advance within the frame of this thesis some ideas in relation to this process. However, some hypotheses as to the possible transformation of the keyboard during this historical organological event have been presented in chapter 1. See also below, note 15.

<sup>3</sup> Given the complexity of the picture behind the conformation of a techno-mechanical approach, I will use at times the more general term 'bodily attitude' to refer to the performer's activity at the instrument. See the introduction, p. 3, and below, p. 67.

The influence exercised by the clavichord upon the organist's professional life, particularly once the instrument established itself as a serviceable tool for the purposes of practicing and teaching,<sup>4</sup> might have not been initially felt far beyond the immediate practical advantages granted by its use (e.g. availability of extended practice times, avoidance of low church temperatures and the necessary reliance on the people required to activate the bellows, which might then have become restricted to unavoidable performances at the organ). On the other hand, it is probable that the clavichord's initial impact on playing technique was limited at first since for some time it might have been handled as an organ rather than as a distinctive instrument. This hypothesis seems to be supported by the information obtained upon the examination of some of the iconographical sources presented below.<sup>5</sup>

The *Glorification of the Virgin* (1489), a painting by Geertgen tot Sint Jans (c.1465–1495), shows a variety of musical instruments among which an organ and a clavichord can be found (see plate 2.1).<sup>6</sup> Both instruments appear to be floating in space, just like all the musicians surrounding the Virgin and the Child. This suggests that the performers at these keyboard instruments are not seated, a possibility which helps to explain the lower position of their bodies in relation to the instrument, particularly when compared to that of the organists in van Eyck's *Ghent Altarpiece* (finished 1432) and Hugo van der Goes's (c.1430/1440–1482) *Trinity Altarpiece*<sup>7</sup> (c.1478–1479) (see plates 2.2 and 2.3). Despite this difference, all four representations share an aspect which is central to the hypothesis presented above, namely, the performer's wrists are located at a much lower level than that of the surface of the natural keys. This physical approach might have originally pertained to the playing at the organ. However, when one only considers the presence of this hand position in the organ iconography above it is difficult to discern with any degree of

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<sup>4</sup> This probably occurred around the time in which both instruments began to display a similar compass and key size. In this form, the organist was to be able to interchange efficiently one instrument for the other.

<sup>5</sup> This idea will be also explored in chapter 5. See below, pp. 182 ff. At this point, it is important to emphasise that the evidence present in iconography cannot be taken at face value. Regardless of how accurate a depiction seems to be, its elements need to be scrutinized as carefully as possible. In this form, it might be possible to avoid introducing potentially flawed arguments. For an example of this situation, see appendix 1.

<sup>6</sup> In the collection of the Museum Boijmans van Beuningen, Rotterdam. The organ can be seen at the upper left corner of the painting, whereas the clavichord is at the lower left one.

<sup>7</sup> At the National Galleries in Edinburgh.

certainty whether the position of the left-hand wrist of the organist in the Ghent altarpiece was already characteristic of organ playing technique before the introduction of the clavichord within the realm of *musica practica*, or if it was adopted later, perhaps as a consequence of this event. On the other hand, it might be safe to suggest that one of the reasons explaining the emergence of a playing technique which involved a higher position of the wrist was the ever-changing spatial allocation of the keyboard allowed by various types of positive organs and clavichords and harpsichords with and without a stand.<sup>8</sup> The effect on the body of the performer of this spatial variation becomes evident through an examination of a variety of representations which show both instruments placed rarely on a stand and often above tables, ledges, rocks, or held on the lap or by a standing person. It is visible particularly on the difference in the level of the performer's elbows and wrists which had necessarily to change according to the specific circumstances.

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<sup>8</sup> For a discussion of some ideas about the possible origin of the lower wrist in keyboard playing, see appendix 1.



Plate 2.1 Geertgen tot Sint Jans, *The Glorification of the Virgin*, Museum Boijmans van Beuningen, Rotterdam



Plate 2.2 Jan van Eyck, *Ghent Altarpiece*, Musicians panels, St Bavo's Cathedral, Ghent





**Plate 2.3** Hugo van der Goes, *Trinity Altarpiece*, the National Galleries, Edinburgh

In the *Weimarer Ingenieurkunst- und Wunderbuch* (c.1520) three depictions of secular scenes include a clavichord, a harpsichord and a portative organ; the first two instruments are placed above a table, the last one above the knee of the seated performer (see plates 2.4 and 2.5).<sup>9</sup>

<sup>9</sup> Stiftung Weimarer Klassik, Herzogin Anna Amalia Bibliothek, Ms. f. 328, f. 120 v. and f. 121 r.



Plate 2.4 Harpsichord and clavichord, *Weimarer Ingenieurkunst- und Wunderbuch*, Stiftung Weimarer Klassik, Herzogin Anna Amalia Bibliothek, Ms. f.328, f. 120 v.

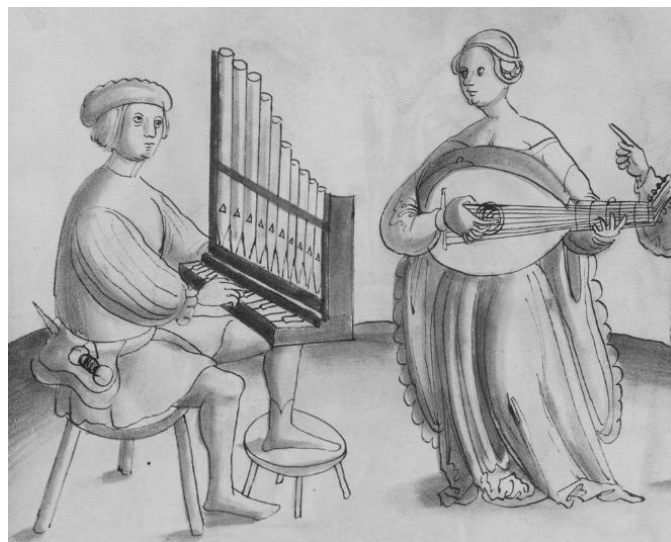


Plate 2.5 Portative organ, *Weimarer Ingenieurkunst- und Wunderbuch*, Stiftung Weimarer Klassik, Herzogin Anna Amalia Bibliothek, Ms. f. 328, f. 121 r.

The drawing in which the harpsichord is found shows a seated performer whose wrists appear to be at a level similar to that of the natural keys' surface. One cannot, though, so easily determine the position of the wrists in the case of the performer at the clavichord, who might be also seated, since he is facing the viewer and the image's perspective is not accurate. If one considers the person at the performer's left—whose right hand seems to be at the level of the table, and his fingers, wrist and elbow appear all to be horizontally aligned with it—one could suggest that enough space would have been available between the surface level of the natural keys and that of the table for the wrists to adopt a low-level position.<sup>10</sup> Nevertheless there would not have been enough room for the wrist and the arm to adopt a position similar to that found in the Ghent Altarpiece since the instrument's keyboard is found well within the surface of the table. A performer seeking indeed to adopt this position could have easily achieved this by placing the instrument's keyboard closer to the table's edge. This move would have made the clavichord's keyboard resemble the protruding keyboard of some organs (e.g. those of the Norrlanda organ and that of the instrument in the Ghent altarpiece).<sup>11</sup> As will be seen below, this appears to have been the case in one depiction of the clavichord, the harpsichord and the organ found in a group of stained-glass windows.

Another fifteenth-century representation of the harpsichord shows an instrument being played by a performer who is probably standing since his back is slightly arched towards the instrument and his elbows are at a much higher level than that of

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<sup>10</sup> One should consider the possibility that a presentation of the position of the hands on the clavichord might have been deemed unnecessary if this was indeed the same as that on the harpsichord. Around the time of the production of the *Weimarer Ingenieurkunst- und Wunderbuch*, the 'grammar of technical illustration' appears to have recommended offering a single presentation of the object intended to be depicted (i.e. without the use of multiple viewpoints). Thus, an intention to represent the same position of the hands on one instrument (i.e. the harpsichord) would have offered the artist the opportunity to present the clavichord from a different view point. For this reason, the position of the hand on the organ seems to be a confirmation that the wrist was probably employed at the same height on all three instruments by the performer or performers being taken as models for the depictions. For a discussion on the 'grammar of technical illustration', see Wolfgang Lefèvre, *Picturing Machines: 1400-1700* (Cambridge Massachusetts: Massachusetts Institute of Technology, 2004), 104–106.

<sup>11</sup> The height of the keyboard on this instrument might have been similar to that found on the Urbino intarsia clavichord, an instrument representation from the year 1476. An image of this instrument can be seen in Ripin, "The Early Clavichord," plate 2; and Brauchli, *The Clavichord*, 35, plate 2.15. The way in which the organ is depicted in the *Weimarer Ingenieurkunst- und Wunderbuch* suggests the existence of a keywell, an element absent in both the clavichord and the harpsichord. Its presence however would not have impeded, if this was indeed intended, the adoption of a low wrist hand position. See also below, note 15.

the keyboard.<sup>12</sup> Under these circumstances playing using a low wrist could be problematic. A similar situation is found in a depiction of a clavichord in a fresco (c.1433) by Leonardo da Besozzo and Perrineto da Benevento. Here the performer is standing straight before an instrument placed above a stand which might have been built specifically for this particular instrument.<sup>13</sup> The resulting height of the keyboard is lower than that of the player's elbows, a situation which would have made it difficult for the performer to adopt a low-wrist hand position.

In all, it appears that in performances away from the organist's church and practice room an ever-changing spatial allocation of the clavichord would have imposed on the performer the necessity to adopt a variety of positions of the hand, wrist and arm. If this was indeed the case, circumstantial adaptation might have unleashed an exploration which would have produced multifarious approaches to the keyboard. In addition, the ways in which the body was to be used might have greatly varied as a result of a combination of variables such as the height of the keyboard, that of the bench (if any), the particular dimensions of the performer's body, the specific requirements of the musical idiom and the performance's circumstances. As I have argued in chapter 1 above, a number of changes in the organological characteristics of the keyboard were to decisively influence the physical approach to the various keyboard instruments. In the German territories in particular, the conjunction of these changes with the emergence of keyboard music originating from an exploration of the instrument<sup>14</sup> seems to have given rise to a remarkable array of fingering practices. At this point, the physical absence of the historical body of the performer

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<sup>12</sup> The performer appears not to be a human being. For this reason, his arms might not represent those of a human performer. The image can be found in Bowles, "A Checklist of Fifteenth-Century Representations of Stringed Keyboard Instruments," plate 20; and Christopher Page, "The Myth of the Chekker," *Early Music* 7, no. 4 (1979): 484. The manuscript containing the image is in Paris, Bibliothèque Nationale, Ms. fr. 331, f. 145v (1468).

<sup>13</sup> Bowles, "A Checklist of Fifteenth-Century Representations of Stringed Keyboard Instruments," plate 2; Ripin, "The Early Clavichord," plate 1.

<sup>14</sup> See John Butt, "Germany and the Netherlands," in *Keyboard Music before 1700*, ed. Alexander Silbiger, 2nd ed. (New York: Routledge, 2004), 152. One of the characteristic elements of keyboard music at the turn of the sixteenth century is the use of canonic imitation, which is one of the topics discussed by Hans Buchner in his 1515 *Fundamentum*. Those changes observed in fifteenth- and sixteenth-century *Fundamenta* could be considered as an indication of the broadening interrelation between the keyboard player and his instrument. For a discussion on the contents of the various extant *Fundamenta*, see Daleen Kruger, "Organ Improvisation in German Fundamenta of the 15th Century," *New Sound* 32 (2008): 35–51; and Butt, "Germany and the Netherlands," 147–157.

today represents a significant gap which prevents a comprehensive visualisation of the ways in which fingering practices were put into use.

Although the necessity to adapt the body might have been evident to church organists—a number of whom were regularly involved in secular performances—it is probable that a significant number of them would have tried to keep the height and spatial projection of the keyboard of their practice instrument resembling those of the church's instrument. In other words, the physical positioning of the organist's clavichord keyboard was probably to be that which would help to simulate as closely as possible the physical conditions the performer would be finding at the organ.<sup>15</sup> This idea appears to be supported by Geertgen tot Sint Jans's *Glorification of the Virgin*—though the clavichord in this source appears as a performance instrument—and by three fifteenth-century stained-glass windows at the Collegiate Church of Saint Mary in Warwick, England, showing a clavichord, a harpsichord and an organ, all of which appear to have a protruding keyboard.<sup>16</sup> These representations are particularly relevant to the idea presented above suggesting that the hand position used in organ playing was to be adopted partly as a result of playing on the clavichord—and possibly also at the harpsichord when this instrument was employed in the church. The Warwick clavichord, which is being played by one angel while being effortlessly held in the air by another, is kept at a height which allows the performer to adopt a low-wrist position. The same characteristic position of the wrist is to be found in the harpsichord's depiction. Here, the performer—who as in the clavichord representation is also standing—attains it without difficulty through the aid of an instrument placed at what appears to be a very high table. More significant is the fact that the instrument's keyboard has been placed close enough to the table's edge, probably to help the arm and the hand to be in a straight line or to allow the

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<sup>15</sup> The idea that the clavichord was adopted as a practice instrument, and that this move took performers to make it to resemble the organ in mechanical operation and visual appearance, seems to be confirmed by some design characteristics of the clavichord which appear to derive from those found on the organ (e.g. the presence of a short octave, protruding keys, and an initial absence of keyboard cheeks). The clavichord found in the Urbino intarsia, although probably a depiction of an instrument intended for theoretical demonstration, might closely resemble those instruments found in the organist's practice room at the time of its depiction. See above, note 11.

<sup>16</sup> These windows were made between 1439 and 1447. See Bowles, "A Checklist of Fifteenth-Century Representations of Stringed Keyboard Instruments," plates nos. 5 (clavichord) and 18 (harpsichord). The organ appears in Stephen Bicknell, *The History of the English Organ* (Cambridge; New York: Cambridge University Press, 1996), 24, plate 6.

arms to remain free to move easily. This situation is thus in sharp contrast to that found in the *Weimarer Ingenieurkunst- und Wunderbuch* and in other contemporary iconographical sources, some of which appear to depict church organists playing during secular occasions.<sup>17</sup>

The fact that a representation of a clavichord and a harpsichord is to be found next to that of an organ seems to speak of an interrelationship of all three instruments with and within the realm of church music-making, even though another sort of interrelation is also reflected in more mundane matters. Albeit the position of the organist's wrists has not been rendered with the same degree of detail as in the two other representations, two issues point to the use of the same basic position of the hands as on the other two instruments: 1) the position of the left hand (which is manipulating some of the chromatic keys placed in an upper row detached from the naturals); 2) the hint of a low wrist on the right hand. The fact that these images are inside a chapel further suggests that it is the organist's practice that is reflected in all three depictions.

While almost a century later, this idea appears to be confirmed by a thorough description of a similar positioning of the hands in Tomás de Santa María's 1565 music treatise *Arte de tañer fantasia*.<sup>18</sup> In chapter XIV 'On the correct hand position' (*Del modo de poner bien las manos*) one learns that

[the... ]—correct hand position—embraces three points. The first is that the hands should be held in the shape of a hook, like cat's paws. The hand and the fingers, then, should not be hunchbacked but rather the knuckles where the fingers join the hands should be kept very low so that the fingers are higher than the hand and arched. In this way the fingers are more flexed, the better to strike the keys, and the notes sound louder fuller and brighter. The importance of perfecting this position is so great and of such value to the music that, apart from the beauty and grace which it gives to the hands, it imparts brilliance and sparkle to everything that is played, making it quite different and altogether distinct from anything played without this hand position. The second point is to keep the hands compact, which is done by keeping the four fingers—the second, third fourth and fifth—of each hand together, and, above all, by holding the second finger close to the third, which can be done better with the right hand than with the left, and this is very

<sup>17</sup> See, for instance, the cases of Paul Hofhaimer who appears to be the organist depicted in the sixteenth-century woodcut '*Triumphzug Maximilians*' (the work of various artists among which were Hans Burkmaier and Albrecht Dürer). See below, plate 2.7, p. 79.

<sup>18</sup> See Santa María, *Arte*, f. 37 r.

conductive to playing smoothly and sweetly. At the same time the thumb should be kept very low, much lower than the other four fingers, but it should be curved inwards and from the second joint to the tip kept under the palm. The little finger, the fifth, should be more curled than the rest so that it almost touches the palm. It is impossible to keep a good hand position without curling the two above mentioned fingers, the thumb and the little finger, of each hand in this way, since the compactness of the hands depends on them. It is not possible to play with the fingers strewn about, particularly the thumb and the little finger, because the hands become clumsy, weak and awkward, as if tied up.

The third point is that the hands should be held in such a way that the three fingers—the second, third and fourth—of each hand are always over the keys, whether they are required to play or not. In addition, the second finger, especially that of the right hand, should be held a little higher than the other three, the third, fourth and fifth.

To achieve a good hand position, and to play well, the arms from the elbows up should be kept close to the body, but not tightly so, although in order to play long ascending runs of quavers and semiquavers with the left hand the left elbow will have to move away from the body. So too, in order to play long descending runs of quavers and semiquavers with the right hand, the right elbow will have to move away from the body.<sup>19</sup>

Two facts suggest that, at the time, the technique might have been in widespread use among Spanish organists: Santa María was himself an organist and the treatise had been examined and approved, prior to its publication, by Antonio and Juan de Cabezón.<sup>20</sup>

As it is, the permanence in Spain of a technique found profusely in fifteenth-century representations<sup>21</sup>—at a time in which some signs of its fall into disuse in other regions are evident—appears not only to attest to the long-existing, far-reaching mutual musical influence between the Iberian Peninsula and the Low Countries.<sup>22</sup> It also seems to speak, on the one hand, for the importance given by the

<sup>19</sup> This English translation is found in Sachs and Ife, *Anthology of Early Keyboard Methods*, 9–10.

<sup>20</sup> See the title page.

<sup>21</sup> In particular those of Flemish provenance above discussed. Various images showing this situation are found in Bowles, “A Checklist of Fifteenth-Century Representations of Stringed Keyboard Instruments,” plates 5, 10a, 18, 21 (these last two images show the harpsichord’s keyboard protruding from the table which supports the instrument) and 27a; and Bowles, “A Preliminary Checklist of Fifteenth-Century Representations of Organs in Paintings and Manuscript Illuminations,” plates nos. 17 and 24.

<sup>22</sup> The position of the organist’s wrist in the Ghent altarpiece, even after the *pentimenti* (from not later than 1432), seems to resemble the one Santa María recommends. The presence of this approach in both geographical regions is perhaps a result of an earlier exchange of ideas among keyboard

man of the Middle Ages to the antiquity of custom or tradition<sup>23</sup> and, on the other, for some possible organological circumstances which might have proved determinant for the preservation of idiosyncratic hand positions (e.g. the probable enduring presence of certain types of church organ console which could have been associated to a particular technique).<sup>24</sup> However, as I will suggest below, Santa María's approach to the keyboard appears to have incorporated some specific uses of the arm and the fingers which might not have been present among the technical skills of some fifteenth-century organists employing the low wrist. Some of these probably innovative playing-technique resources may have originated as a response to the new figurations present in contemporary musical idioms, some of which might not have been easily negotiated through the use of the specific set of movements hitherto associated with the basic low-wrist playing technique.

As I have argued above, the spatial positioning of the clavichord and the harpsichord as shown in the Warwick stained-glass windows suggests that both instruments might have been placed at the appropriate height which would have allowed the organist to encounter similar physical playing conditions as those found at the organ.<sup>25</sup> Nevertheless, relying solely on an analysis of the sources presented in this chapter one can certainly not prove conclusively that the use of a low wrist had its origin in organ playing. There are however some sources related to the playing of the portative organ which, under closer scrutiny, might reveal this to be the case.<sup>26</sup> On the other hand, it appears that the use of a low wrist might have been still a

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performers of the Iberian Peninsula and the Low Countries. Evidence of this exchange can be inferred from e.g. a 1388 letter from King John I of Aragon to Philip the Bold of Burgundy in which John asks for the 'ministrer' Johan del orguens to be sent to him. See above, chapter 1, note 63. On the presence of other foreign organists in fourteenth-century Spain, see Kimberly Marshall, "The Organ in 14th-Century Spain," *Early Music* 20, no. 4 (1992): 549–557.

<sup>23</sup> On these ideas, see Jacques Le Goff and Nicolas Truong, *Una Historia Del Cuerpo En La Edad Media / Une Histoire Du Corps Au Moyen Âge*, trans. Josep M. Pinto (Barcelona: Paidós, 2005), 87–88. See also the discussion by François Couperin on thirds in François Couperin, *L'Art de Toucher Le Clavecin / Die Kunst Das Clavecin Zu Spielen / The Art of Playing the Harpsichord* (Wiesbaden: Breitkopf & Härtel, 1961), 20, and Fernand Braudel, *Civilization and Capitalism, 15th-18th Century*, vol. 1 (New York: Harper & Row, 1985), 56.

<sup>24</sup> Michael Praetorius reports, as late as 1619, that the dimensions of the keys on the Halberstadt organ greatly exceed those of contemporary instruments. See above, chapter 1, note 32.

<sup>25</sup> Although the presence of handles suggests the organ in this source was a portable one, its overall size denotes it was to be placed on the floor. This results in a fixed height of its keyboard. The organ in the Ghent altarpiece also displays a handle, although of a more discreet size, on the left side of the instrument.

<sup>26</sup> This idea will not be explored in this thesis.



distinguishing conventional technical characteristic of the playing of more than a handful of church organists throughout the sixteenth century until its ultimate fall into disfavour. It is through Girolamo Diruta's late sixteenth-century treatise *Il Transilvano* that one can sense that this technique was already considered as inadequate by some Italian musicians.<sup>27</sup> This also suggests that the contrasting hand and wrist position he advocates (see below) had for some time been in customary use by some high profile performers.

In the second part of *Il Transilvano* Diruta recognises 'Gioseffo Zarlino, Constantio Porta & Claudio Merulo' as his preceptors.<sup>28</sup> Yet it appears that it was Claudio Merulo (1533–1604) who had exercised the most profound influence on his playing technique, something which both Merulo and Diruta acknowledged.<sup>29</sup> This would suggest that, to a large extent, it is Merulo's practice which Diruta might have attempted to codify in his treatise. This situation would confirm that the technique which considers the positioning of the arm as described by Diruta was already established by the second quarter of the sixteenth century among some of the leading Italian performers.

Diruta indicates that the hand should be held 'lightly and easily over the keys', and that it 'should always be straight in relation to the arm'.<sup>30</sup> This will only be possible when '[...] the wrist is held somewhat high, because thus the hand will be level with the arm'.<sup>31</sup> Diruta's indications seem to be already present in the depictions of the keyboard performers found in the *Weimarer Ingenieurkunst- und Wunderbuch*. Here, both the harpsichordist and the organist appear to hold the elbows at a higher level than that of the keyboard and the hand seems to be levelled with the arm.<sup>32</sup> This evidence suggests that this approach to the keyboard might have originated in the

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<sup>27</sup> The English translation of the passages of this book quoted here is taken from Carol MacClintock, *Readings in the History of Music in Performance*, 1. Midland ed. (Bloomington & Indianapolis: Indiana University Press, 1982), 89. Some of the possible reasons behind the fall into disuse of this technique will be examined below.

<sup>28</sup> Girolamo Diruta, *Il Transilvano (1593, 1609)*, *Bibliotheca Organologica V. 44*, Facsim. (The Netherlands: Frits Knuf Buren (Gld.), 1983), 11.

<sup>29</sup> Merulo, in a letter published at the opening of the treatise, proudly observes that Diruta was 'his creature'. For Diruta's comments on the influence of Merulo on his playing, see *ibid.* f. 36 r.

<sup>30</sup> MacClintock, *Readings in the History of Music in Performance*, 88.

<sup>31</sup> *Ibid.* 88.

<sup>32</sup> The same situation might be the case for the clavichord. See above, note 10. See also the discussion below on the impact of the instrument on the music and playing approaches.

German territories.<sup>33</sup> The apparent similarity in the approach to the keyboard in these two sources points to two basic ideas: on the one hand, Diruta's criticism of those who still play with a low arm<sup>34</sup> indicates that this technique died hard; on the other hand, the presence of a high levelled arm in early sixteenth-century iconography suggests that this type of physical approach had already been in use before Merulo's time.<sup>35</sup> However, the flowering of a keyboard idiom as a result of the moving away from the mere imitation of vocal practice<sup>36</sup> and the continued influence of dance on the performance of music should also be considered among the reasons behind these changes.<sup>37</sup>

The discussion that follows will attempt an explanation of some of the historical views on fingering and the placing of the hand and the arm as a response to the changes both the keyboard instrument and its music underwent during the fifteenth and sixteenth centuries. It is hoped that the description of this panorama will expand our views on the physical aspect of keyboard technique and particularly on the practices present at the end of the seventeenth century and the first decades of the eighteenth.

## Historical physico-mechanical approaches

One of the most prominent contrasts between the keyboard idiom of Conrad Paumann (c.1410–1473) and that of organists such as Paul Hofhaimer (1459–1537),

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<sup>33</sup> The presence of the organ in both religious and secular performances and its prominent use by professional and amateur musicians speak for the high regard in which Germans held the instrument. This situation seems to have contributed to the quality of both performance and instrument building in these territories, and, therefore, to a high demand of these professionals abroad, particularly in Italy. See Keith Polk, *German Instrumental Music of the Late Middle Ages: Players, Patrons, and Performance Practice, Cambridge Musical Texts and Monographs* (Cambridge: Cambridge University Press, 2004), 15–16. See also below, pp. 75–76.

<sup>34</sup> MacClintock, *Readings in the History of Music in Performance*, 89.

<sup>35</sup> Two important sources depict the organ player (in both cases a female player—probably Frau Musica) holding the arm at the same level as that of the hand: the title page of Arnolt Schlick's 1511 *Spiegel der Orgelmacher und Organisten*, and the representation of the profession of organist in Hans Sach's 1568 *Ständebuch*. For a discussion on the identity of the female player, see Fabrice Fitch and Jacobijn Kiel, eds., *Essays on Renaissance Music in Honour of David Fallows: Bon Jour, Bon Mois Et Bonne Estrenne* (Woodbridge: Boydell Press, 2011), 357–358. The presence of a high wrist in Sofonisba Anguissola's 1561 self-portrait at the spinet seems to speak for the presence of this position of the wrist in secular circles.

<sup>36</sup> See Butt, "Germany and the Netherlands," 152.

<sup>37</sup> An examination on how dance might have influenced the shaping of these practices will need to be attempted in another study.

Arnolt Schlick (c.1460–1521) and Hans Buchner (1483–1538) is the more frequent presence in the music of the latter composers of single-direction scalar motives of an extension exceeding a fifth. The embellishments in Paumann's melodies are generally based on the use of ornamental figures such as turns and ascending or descending four-note groups. A consequence of this limited rise and fall of notes is that usually no more than six successive ascending or descending notes will be found in his music (see figures 2.1 and 2.2).<sup>38</sup>



Figure 2.1 *Fundamentum Ascensus Simplex*, f. 124 v., bar 8, *a'-f''*



Figure 2.2 *Fundamentum, Clause de ut in fa et contra ut re mi fa fa mi re ut*, f. 126 r., bar 2, *b-g'*

<sup>38</sup> One instance of this situation would consider the following notes aligned in the same direction: the last note of a four-note group followed by a group made up of four ascending or descending notes leading to the first note of a third group (or single note). One can exceptionally find seven-note sequences. See, for instance, *Redeunt In Idem mi de eadem mensura, fa b b fa b fa*, bar 2, in Bertha Antonia Wallner, ed., *Das Buxheimer Orgelbuch*, vol. III (Kassel; Basel; New York: Bärenreiter, 1959), 334. In the discussion that follows I will consider the notes belonging to those groups at either side of a central group (i.e. that featuring four ascending or descending notes) as a component of the complete ascending or descending movement. This does not mean that the central-group notes and those at either side necessarily form together a musical unit. This single-direction grouping has been established exclusively to aid here the inquiry into some of the practical reasons that might have been behind the performer's choice of a particular fingering. The figures are taken from *ibid*, 287 and 293.

Since the earliest available evidence regarding fingering practices is only found in Hans Buchner's *Fundamentum*,<sup>39</sup> it is difficult to establish, let alone be certain, how Paumann used to finger these runs. If, however, those hypotheses formulated in chapter 1 above (concerning the origin of some particular uses of the fingers on the keyboard as a consequence of the playing on late fourteenth- and early fifteenth-century instruments with distinctive organological characteristics) and the information around fingering in Buchner's text are considered together, one may infer that Paumann and his contemporaries might have negotiated these runs relying mainly on the use of the long fingers.<sup>40</sup> Resulting from this knowledge, two basic technical solutions might have been called for when attempting to play a single-direction motive or a sequence of four or more diatonic notes:

1. Hand position switching: after playing the initial notes with the three long fingers in sequence a swift switching of the hand in the direction of the scale's movement would allow the performer to relocate, in the first of the following remaining ascending or descending notes, either the second or the third fingers of the right hand, when ascending, or the fourth or the third fingers of the right hand when descending (e.g. a right hand ascending sequence *d-e-f-g-a-b* could be played with the finger succession 2–3–4–2–3–4, the hand position switching being found between the *f* and the *g*.<sup>41</sup> A shorter sequence *d-e-f-g-a* could be taken with a fingering 2–3–4–3–4, although 2–3–4–2–3 is also possible). The hand position switching can be executed either with the aid of the wrist, a lateral movement of the arm, or a combination of both. Depending on how the fingers and the hand are placed at the keyboard and the particular historical demands on them (e.g. fingers close to the key, or an avoidance of a withdrawing movement of the finger

<sup>39</sup> See Hans Buchner, *Sämtliche Orgelwerke*, ed. Jost Harro Schmidt, vol. 1 (Frankfurt: Henry Litolf's Verlag, 1974), 2–34.

<sup>40</sup> One can consider the possibility that the thumb was used at the end of the four-note group, preceding the principal group and, thus, in the position to begin the ascending scale (see *ut re mi sol sol mi re ut*, bar 3, in Wallner, *Das Buxheimer Orgelbuch*, Vol III, 295). However, the evidence found in Buchner suggests that the thumb might only have been used when playing harmonic intervals with a single hand (e.g. in *Quem terra pontus*, tenor, bar 3–4. See Mark Lindley and Maria Boxall, eds., *Early Keyboard Fingerings: a Comprehensive Guide* (London: Schott, 1992), 34).

<sup>41</sup> As will be suggested below, this is the technique Santa María might have been considering, depending on the speed of the notes, when recommending the use of the finger sequence 1–2–3–4–1–2–3–4. See below, p. 80.

after playing), the arm could remain almost motionless when the position of the hand is switched from the wrist. On the other hand, the wrist could be kept practically motionless during a change of the hand's position when the movement is solely induced from the arm. In both cases the speed of the notes will probably help to choose the necessary movement.

2. Finger crossing: the performer could also reach the key beyond the limit established by the initial playing of the three long fingers through a movement in which a long finger turns over a shorter one (e.g. the *e* and *d* in a right-hand descending sequence *a-g-f-e-d*, in which the fourth finger takes the *a*, could be easily taken by the third and the second finger respectively—i.e. the middle finger would have to turn over the shorter index). As I will argue below, the complexity of the movements involved in this technique might impact on the smoothness of the flow of notes.

A perusal of Paumann's music will reveal that various semiquaver sequences, made up of turns and ascending or descending note groups, are often confined to an interval not larger than an eleventh. In his keyboard idiom the length of single-direction groups<sup>42</sup> does not usually exceed five or six notes before a change of melodic direction appears. Thus, a combination of several turns and/or ascending or descending groups are in general necessary before the highest or lowest note of this intervallic border could be reached through the broader ascending or descending melodic movement (see figure 2.3). This situation, together with the fact that the frequency of use of the chromatic keys is generally limited, appears to permit a seemingly smooth and comfortable use of the movements involved in the two techniques described above.

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<sup>42</sup> See above, note 38.



**Figure 2.3** Melodic movements in *Clausule de ut in sol et contra ut re mi fa sol sol fa mi re ut*, f. 126 v., bar 3–4; (1) broader melodic movement; (2) broader melodic-movement interval (i.e. 11<sup>th</sup>, *b-e'*); (3) single-direction group; (4) turn; (5) ascending-descending group

At this point it becomes clear that the lack of detailed directions by Paumann or any of his contemporaries regarding the positioning and the particulars of the physical action of the hand, wrist and arm hinders an in-depth visualization of the physical approach likely to have been put into practice during the performance of specific passages. This situation does not improve in the case of Buchner. In his *Fundamentum* he presents his readers with a set of fingering rules which are intended to help to establish a common knowledge foundation from which anyone could begin and deal on his or her own with particular fingering cases.<sup>43</sup> However, the absence of a detailed description of the particulars of the physical interaction between the performer and the instrument when applying these fingerings makes any modern attempt to nuance the basic movements most likely involved in their use particularly difficult. Moreover, the necessary consideration of other aspects of keyboard playing on which the finding of a suitable physical approach to the keyboard will also depend—from the relation between the organological characteristics of the instrument and the physical constitution of the performer to the particular elements of a keyboard idiom—further complicates the problem. It would be then rather naïve to attempt to construe a description of an ur-technique, as in practice the changing character of the various aspects behind the physical element of a performance would prevent the use of any ‘basic’ physical component of the bodily action in a ‘pure’ form. Finally, and probably most importantly, one would need to keep in mind that the body of the performer, responsible for the motor action required during performance, has to be considered as having been shaped by—and one which helps

<sup>43</sup> Hans Buchner, *Sämtliche Orgelwerke*, ed. Jost Harro Schmidt, vol. 2 (Frankfurt: Henry Litolf’s Verlag, 1974), 2.

to shape—the beliefs and contemporary practices of the distinctive and complex socio-cultural reality in which it exists.

A consideration of the arguments presented above would make it difficult to go beyond a brief analysis of some of the technical issues allegedly involved in the practice of performers from the sixteenth to the eighteenth centuries without having to introduce, sooner or later, intricate hypothetical ideas regarding the mechanical uses of the body. Consequently within the frame of this study only a limited number of the aspects involved in the interaction of the body of the performer with the instrument will be taken into account. These aspects will in principle be those which could, to an extent, aid later in the building of an understanding of some of the more specific bodily approaches that certain musicians of the past appear to have adopted during a performance. I suggest that particular approaches are codified in textual descriptions and iconographical depictions of musicians in performance, and may be also identified through an examination of the physical evidence of wear found in the surface of the keys of historical instruments.

The term ‘bodily attitude’ will be used here to denote the physical action of the performer’s body during his or her interaction with the keyboard and which results from an exposure to, or consideration in thought of, certain stimuli. It is thus a response, for instance, to the reading of the musical score, the recollection of learned music, the listening to other performers, the audience’s reactions to the music performed, etc. One must keep in mind that these stimuli—socio-historical constructions that define, and are also defined by, the physico-mechanical aspect of performance—are to a large extent qualitatively determined by the socio-cultural reality within which a person has been brought up. Particular attention has then to be given to the way in which some of the physical responses of the body are fashioned as a result of its presence within a given reality. At the same time, an acknowledgement that the performer’s physical responses would need to conform to the prevalent organological conditions, through a consideration of the body’s biomechanical characteristics and capabilities, is unavoidable. In other words, although the required bodily action in instrumental performance is to a great extent the product of a specialized training which takes into account the body’s

biomechanical possibilities and limitations, this training will still take place, as well as the performance, within a unique socio-cultural reality. The components of this reality thus help to define a performer's techno-mechanical approach to an instrument. How these socio-cultural components nuance the learning of a playing technique and its use in performance is something which might be difficult to follow up and should be attempted elsewhere. Thus, and in order to gain a broader understanding of some of the physical approaches found in performance, it will be necessary to identify some of the reasons and clarify the ideas and beliefs explaining the adoption and development of idiosyncratic bodily attitudes in performance. This will be briefly discussed in the last two chapters of this work where besides attempting to address the influence of the religious aspect of society in musical performance I will also explore the possible ways in which, as a consequence of this and other socio-cultural circumstances, the body might have been fashioned. Hence, in the remainder of this chapter the mechanical nature of a limited number of aspects of keyboard playing will be discussed. This analysis will be made following the aforementioned premise that the more complex bodily attitudes responsible for distinctive musical outcomes are partly the result of the learning of the art of performance within a particular socio-cultural reality.

## Practices

The building of an understanding of a performer's bodily attitude has perhaps to begin with an inquiry into the processes that lead to the fusion of its physico-mechanical and socio-cultural components. The physico-mechanical component of a bodily attitude will be defined by the prevailing biomechanical and mechanical conditions of the body-instrument system.<sup>44</sup> Within this system there are some general physical conditions that are shared by all instruments and bodies for which reason an equally shared set of general movements and responses is required (e.g., independently of the instrument's action characteristics the key will always require, in order to activate it, a downward movement from the performer's body). In chapter 1 above I have advanced some ideas regarding the possible ways in which particular

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<sup>44</sup> The term 'physico' in the expression physico-mechanical refers to the physicality of the performer understood as a biomechanical capacity. This movement might be regarded, at least theoretically, as not culturally conditioned. See below.



forms of interaction between the keyboard and the organ player might have originated; these ideas were complemented with an overview of the impact of the clavichord's spatial positioning on playing approaches to the organ. In all, the evidence presented in both discussions seems to support the view that the specific handling of the keyboard in which sequences of keys are pressed following the rules of fingering systems firmly rooted on the use of paired fingers was the one through which the workings of the instrument's action were initially recognised and became largely available for the purposes of performance.<sup>45</sup> This handling seems to have been practiced by a large number of professional keyboard players until, after having outlasted several keyboard idioms and instrument designs, it became unfashionable.<sup>46</sup> Less obvious perhaps is the idea that in some respects this specialised—yet basic—handling could be seen as a mechanical departure point for more elaborated musical practices such as articulation. These might have been the result of a consideration of the particular characteristics of an instrument, the circumstances in which a performance took place, and the requirements of the musical idiom. Consequently, here I will attempt to enlarge our insight into the techno-mechanical components of a bodily attitude through an analysis of the information regarding fingering practices found in some historical music manuscripts, treatises and tutors. In these sources one can find examples of fingered music that make it possible to understand the sequential order in which the fingers are used. These examples however do not permit us to establish with clarity, as has been pointed out above in the case of Buchner, any other specific aspects of the physicality that the performer might have needed to call into play when attempting to follow the rules and finger sequences written down in the score.<sup>47</sup> Moreover, it will be difficult to establish how these bodies might have initially perceived, processed, assimilated and then applied those movements involved in the performance of music at the keyboard unless a picture of

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<sup>45</sup> Other approaches to the keyboard were certainly to be found. See appendix 1. Needless to say, these approaches might have been abandoned as a result of their limited or null use in music involving polyphony or fast passage work.

<sup>46</sup> The last remnants of this lasting process can still be found at the turn of the nineteenth century. See e.g. Daniel Gottlob Türk, *Klavierschule Oder Anweisung Zum Klavierspielen Für Lehrer Und Lernende*, ed. Siegbert Rampe, Facsimile (Kassel: Bärenreiter, 1997), Ch. II, Part II, § 19. A final departure from these fingering practices might have only taken place when performers were forced to modify their technical approach as a consequence of the demands of some keyboard idioms.

<sup>47</sup> This is particularly clear in the earliest ones. See below for a discussion on the particular cases of Santa María and Diruta.

the socio-culturally shaped body of men and women of specific historical periods is drawn. Since these specialised playing movements correspond necessarily to unique historical conceptions of the art of performance, any effort to try to picture their impact in performance has also to consider the particular historical body that attempts to use them.<sup>48</sup>

The complex picture described above suggests that a study of the techno-mechanical component of the performer's bodily attitude should begin with a consideration of particular elementary physical aspects that could be evaluated without necessarily having to attribute an immediate socio-cultural influence to their adoption and occurrence. This is what could be theoretically considered as a study of the 'bio-mechanical' component of movement (i.e. a corporal action or adjustment detached of any cultural meaning).<sup>49</sup> A description of the *raison d'être* behind such basic aspects of a keyboard technique might aid in the search for an understanding of the shaping process of some of the more specialised techno-mechanical components of performance. Within the frame of the following section I intend thus to present a few examples of a type of movement or posture adjustment of the body which can be said to be solely determined by the interaction between mechanics and biomechanics. These examples will serve as a departure point for an analysis of some historical keyboard playing practices in which these movements or postures are involved. This examination will hopefully help in later efforts to build specific pictures of historical techno-mechanical approaches.

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<sup>48</sup> Behind this idea lies the consideration that different culturally-shaped bodies coexist within the same historical period. The simultaneous presence of these bodies is the result of contemporary contrasting social, cultural and political conditions within the different realities of institutions (such as guilds and confraternities), city areas, and larger regions and territories. The idea is also particularly relevant to our own attempts to visualise the practices of the past since these are necessarily made through our own body. It should thus be considered that our knowledge of the world—as well as that of our ancestors—depends on the interaction of our bodies (which includes the brain) with the environment and the society in which we live. Emotion plays a fundamental role in the assimilation of and response to those concepts encountered during this interaction. On these issues, see Marcel Mauss, "Techniques of the Body," in *Techniques, Technology and Civilisation*, ed. Nathan Schlanger (New York; Oxford: Durkheim Press/Berghahn Books, 2006), 77–96; and Mark Johnson, *The Meaning of the Body: Aesthetics of Human Understanding* (University of Chicago Press, 2007).

<sup>49</sup> On a possible categorization of performance movements, see Mine Doğan-tan-Dack, "In the Beginning Was Gesture: Piano Touch and the Phenomenology of the Performing Body," in *New Perspectives on Music and Gesture*, ed. Anthony Gritten and Elaine King (Aldershot: Ashgate Publishing, Ltd., 2011), 252.

## Santa María

One of the most characteristic physical approaches to the keyboard is that described by Tomás de Santa María in his treatise *Arte de tañer fantasía* (published in 1565 but completed some years before).<sup>50</sup> In this work Santa María painstakingly explains the physicality of a number of practices (e.g. see above, pp. 58–59) which give origin, as a result of their intertwining, to distinguishable physico-mechanical approaches. Some of these practices, such as the use of a low-wrist hand position, might have fallen into disuse as a consequence of the ever-changing character of keyboard cultures. Since subsequent physico-mechanical approaches might in part have derived from or originated as a response to the possible limitations imposed by those preceding them it will be necessary to inquire first into the reasons explaining the existence of any of these earlier practices.

Santa María does not discuss in detail some basic aspects of the organology of the keyboard such as the size and weight of the key. Without this information the building of a physico-mechanical understanding of the corresponding historical player-instrument system becomes more intricate. In an attempt to inform this point I propose to explore briefly, in parallel to the analysis proposed above, those ideas by Santa María, in combination with the information that iconographical, historical and organological sources can provide, which might help to shed some light upon the possible characteristics of the keyboard during his lifetime. In the end it is hoped that this information will also help to illuminate some of the reasons behind Santa María's physico-mechanical choices.

When viewed side by side the keyboards of the Norrlanda organ and those depicted in the Ghent altarpiece, the *Scenes from the Life of the Virgin*,<sup>51</sup> and Praetorius' *Syntagma Musicum* (i.e. the keyboards of the 1361 Halberstadt organ) offer robust evidence that the design of the keyboard might have been similar in various European latitudes at least until the first decades of the fifteenth century. The

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<sup>50</sup> The work dates from c.1541–1557. Due to a shortage of paper the treatise was not printed until 1565. See Almonte Howell and Miguel A. Roig-Francoli, “Santa María. Tomás,” *Grove Music Online* (Oxford University Press, 2012).

<sup>51</sup> Unknown master, Dutch School, early fifteenth century. Koninklijk. Musea voor Schone Kunsten, Brussels, inv. no. 999. See Maarten Albert Vente Flor Peeters, *The Organ and Its Music in the Netherlands* (Antwerp: Mercatorfonds, 1971), 40–41.

coincidences found between the keyboards of these instruments could be related to the presence and influence throughout Europe, and particularly in the Italian and Iberian Peninsulas, of north European builders. These coincidences might have dimmed with the appearance of some local organ building traditions throughout the fifteenth century.<sup>52</sup> Yet, the fact that the Spanish organ appears to have been very similar to the one built in northern Europe until around 1580 suggests that the presence in the peninsula of instruments similar to those appearing in the *Scenes from the Life of the Virgin*, and the Ghent altarpiece and Hugo van der Goes's *Trinity Altarpiece*, was indeed very probable and, perhaps, even more prolonged than in other regions.<sup>53</sup> In addition, the exchange of physico-mechanical approaches within these territories could at various times have been facilitated by the strong historico-political bond between them.<sup>54</sup> As has been suggested, a sociological element related to the observance of tradition might have been behind the permanence of approaches superseded in other latitudes.<sup>55</sup> However, one should also consider that a longer permanence of particular organological conditions in the instruments of a region could also have helped to preserve some of the playing approaches that might already have been abandoned in other latitudes.

A clear instance of this situation is Santa María's stipulation on the use of a low-wrist hand position. His request for the use of this particular physico-mechanical means of playing could in part derive from the possible presence in the Iberian Peninsula of keyboards with short natural keys, possibly in the lines of those visible in the keyboards in van Eyck's and van der Goes's altarpieces and a wood carving by

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<sup>52</sup> Early fifteenth century organ specifications appear to have been similar in countries such as Italy, France and Spain, something which suggests that a resemblance of other organological characteristics could have existed. This might have been partly due to the presence of north European builders in these countries. They appear to have been highly influential in Italy until the middle of the century when the work of Italian builders began to gain a distinguishing character. See Douglas Bush and Richard Kassel, eds., *The Organ: An Encyclopedia* (New York: Routledge, 2006), 274.

<sup>53</sup> On the influence of the Netherlands on organ building in Spain during this period, see Nicholas Thistlethwaite and Geoffrey Webber, eds., *The Cambridge Companion to the Organ* (Cambridge: Cambridge University Press, 1998), 164–165; and Bush and Kassel, *The Organ: An Encyclopedia*, 528. On the relation between Spain and the Netherlands, see *ibid.* 341. See also above, note 22.

<sup>54</sup> A case in point is the possible influence of Spanish fingering systems upon Jan Pieterszoon Sweelinck. See Ludger Lohmann, *Studien Zu Artikulationsproblemen Bei Den Tasteninstrumenten Des 16.-18. Jahrhunderts* (Regensburg: G. Bosse, 1982), 148–149.

<sup>55</sup> On the issue of tradition, see above, note 23.

Adriaen van Wesel (1475–1477).<sup>56</sup> This organological condition would impose on performers attempting to use the thumb a specific biomechanical response related to the spatial level of the wrist (i.e. in relation to the level of the natural keys’ surface):<sup>57</sup> if a high-wrist hand position were to be used in a keyboard with short-length key heads the fingers would be forced to cram between the front edge of the natural-key plate and the chromatic-keys’ front. Another consequence of this approach is that the thumb would be forced to play the key with the front half of the distal phalange, thus increasing the chance of striking it with the nail. When, on the other hand, the wrist is brought to a level below the surface of the natural keys the long fingers can easily play with ‘the fleshy part of the fingertips so that the nail do not meet or touch the keys’.<sup>58</sup> At the same time, the thumbs would be in the position to attack the front edge of the key with the rear of the distal phalange, avoiding in this way the contact of the nail with the key. As a result of the use of this second approach the thumb will be in an angled—rather than parallel—position with respect to the surface of the natural keys.<sup>59</sup>

The use of a low-wrist hand position might well have had its origin in the playing of some types of portative organ.<sup>60</sup> But the reasons that took performers, on the one hand, to transfer this approach to other keyboard instruments and, on the other, to preserve its use, might have to do with cultural responses to tradition, or the physical advantages it appeared still to offer during performance (e.g. it might have helped to prevent limb stress when having to play under fluctuating keyboard level conditions). This could lead to the conclusion that the use of this physico-mechanical approach makes it possible, at least for some time, to play with ease at short key-head keyboards, and/or at an instrument where the level of the keyboard was too high to keep the arm at the same level of that of the hand. But while Santa María takes pains

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<sup>56</sup> In the Rijksmuseum, Amsterdam. This woodcut was originally part of an altarpiece at St Jan’s Cathedral in Den Bosch showing scenes of the life of the Virgin. For images of the clavichord in this altarpiece wood carving, see Bowles, “A Checklist of Fifteenth-Century Representations of Stringed Keyboard Instruments,” plate 10 a and b.

<sup>57</sup> The use of the thumb is confirmed by its presence in the fingerings Santa María recommends. Another piece of evidence confirming the use of this finger is the wear on the front edge of the keys of some historical keyboard instruments. For a thorough discussion of this issue, see chapter 5 below.

<sup>58</sup> Santa María, *Arte*, f. 37 v.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 10.

<sup>59</sup> For a discussion on this angle, see below, chapter 5, pp. 213 ff.

<sup>60</sup> Brauchli, *The Clavichord*, 255.

to stress ‘[t]he importance of perfecting this position’ of the hand,<sup>61</sup> thus reflecting the prominent place this technique occupied within the art of playing he describes, some of his fingering rules appear to suggest, as I will argue below, that this approach was already becoming a hindrance.

The introduction of musical idioms incorporating more complex and faster figurations might have imposed unsuspected demands on keyboard players—particularly on those whose techno-mechanical approach was based on the use of the low-wrist hand position. This situation may have encouraged some of them to search for alternative biomechanical approaches that would enable performance with the new required agility. Although this might have been the situation in some regions, such as the Iberian Peninsula, in others it was precisely this physical agility which appears to have driven some keyboard idioms into particular directions. I suggest that the player’s newly-gained facility and agility at the keyboard were in part a result from the presence of an important organological modification to the keyboard, namely, the increase in length of the key head. This modification might have been made at the request of performers well aware of the playing possibilities allowed by the use of a higher hand position (e.g. a more simple use of the thumb—as it was now to remain above the key—and the playing of longer and faster runs with ease).

It is possible that at the turn of the sixteenth century a significant number of Italian and German keyboard instruments might have presented a keyboard with longer key heads than those Iberian instruments of the same period displayed. This hypothesis arises from the evidence provided by various iconographical sources and the five extant sixteenth-century clavichords. Let us consider at first the clavichord depicted in the 1476 wood intarsia at the *Palazzo Ducale* in Urbino, Italy.<sup>62</sup> Although a real instrument showing the tangent distribution present in the intarsia may possibly have exclusively served the purposes of theoretical demonstration (e.g. of a tuning

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<sup>61</sup> Santa María, *Arte*, f. 37 r.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 9.

<sup>62</sup> See above, note 11. One reconstruction of this instrument shows a distinctive key-head length, i.e. Jean Maurer’s instrument at the Bate collection of musical instruments, Oxford. See Brauchli, *The Clavichord*, 37. In his analysis of the intarsia, Pierre Verbeek suggests a length of 40.3 mm for the key head of this instrument. This value is much larger than that found in other instruments: e.g. a clavichord by Domenico Pisarenensis (Grassi Museum für Musikinstrumente der Universität Leipzig, Leipzig, cat. no. 1): 36 mm; and an anonymous clavichord (ibid. no. 2): 31mm. See Pierre Verbeek, “Reconstruction of the Urbino Clavichord” (Magnano, 2011), electronic document, 39.

system),<sup>63</sup> the degree of detail of this representation suggests that some of the intarsia's details might have been taken from a real instrument. Among these details, one can observe the presence of cranked key levers. For sure, the presence of this organological characteristic (which distinguishes the instrument from some extant sixteenth-century Italian instruments)<sup>64</sup> would seem to imply that the instrument taken as a model might have been of northern provenance,<sup>65</sup> perhaps originally from the German territories rather than from the Low Countries.<sup>66</sup> Nevertheless, clavichords with cranked keys appear to have been built in south Italy already by the first half of the sixteenth century.<sup>67</sup> There is then a possibility, considering the closeness of this historical event to the date of the Urbino intarsia, that this organological element was already present in some Italian instruments built during the last three decades of the century. Moreover, the organological similarity between two anonymous mid-sixteenth-century clavichords with cranked keys,<sup>68</sup> both also the earliest extant clavichords, points to the existence of a bidirectional exchange of organological information between the German territories and the Italian Peninsula rather than to the mere adoption of German building methods by Italian builders.

Two iconographical documents give a glimpse of the possible way in which the technological exchange between both geographical regions might have taken place. These serve also to shed some light upon some of the features characterizing the

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<sup>63</sup> This instrument appears to have served to illustrate the Pythagorean tuning. See Brauchli, *The Clavichord*, 36.

<sup>64</sup> For instance, Domenico Pisaurensis, Grassi Museum für Musikinstrumente der Universität Leipzig, Leipzig, cat. no. 1; and an anonymous Italian clavichord from mid-sixteenth century in the collection of Luigi Ferdinando Tagliavini, Bologna. Both present a key lever disposition which resembles a fan. On these instruments, see *ibid.* 62–72.

<sup>65</sup> See *ibid.* 68–69.

<sup>66</sup> This is suggested by the knowledge of the presence of German musicians in the Peninsula as a consequence of the constant demand for their services. However, the presence of ensembles associated in some form to the Burgundian region and its court, particularly during the middle of the fifteenth century, might have brought together musicians of a distinct social level, perhaps more closely related to those artisans responsible for the creation of the Urbino intarsia. On the circulation of court musicians during the fifteenth century, see Howard Mayer Brown and Keith Polk, "Instrumental Music," in *Music as Concept and Practice in the Middle Ages*, ed. Reinhard Strohm, vol. III.1 (New York: Oxford University Press, 2001), 108–112, especially 108–109. On the reasons behind the flow of German musicians into Italy, see *ibid.* 109–110, and above, note 33.

<sup>67</sup> For instance, Grassi Museum für Musikinstrumente der Universität Leipzig, Leipzig, cat. no. 2.

<sup>68</sup> The instruments (both c.1540) are in the Grassi Museum für Musikinstrumente der Universität Leipzig, Leipzig, catalogue numbers 2 and 3. Although these instruments are very similar in their organology, no. 2 appears to have been built in southern Italy, while no. 3 seems to be of German provenance. See Brauchli, *The Clavichord*, 56–62.

particular circle of musicians which might have instigated the introduction of the longer key head. Both the clavichord in an Italian *fresco* by da Besozzo and da Benevento (dated c.40 years before, c.1433),<sup>69</sup> and the instruments in the *Weimarer Ingenieurkunst- und Wunderbuch* (dated c.40 years after, c.1520; see above, plates 2.4 and 2.5), show short-length key heads. These documents serve thus to attest to the presence of this organological characteristic of the keyboard in Italian instruments before, and German after, the Urbino intarsia with its long key head. The presence of the short key head in the *Weimarer Ingenieurkunst- und Wunderbuch*'s instruments also supports the idea that a number of German builders might have taken a long time before they were to introduce the long key in their instruments. This is particularly evident, especially on the assumption that the position of the hands in this source is significant,<sup>70</sup> in the depictions of the three performers, all of which show a high-wrist hand position.<sup>71</sup> In all, it appears that, at least for some time, the technological innovation the introduction of a longer key head represented was to be observed on a limited number of instruments. These were probably those on which highly influential performers used to perform.<sup>72</sup>

Two further examples might help to focus on the issue of the influence of performers in the organology of the keyboard. In an engraving belonging to his *Darstellungen aus dem Alltagsleben* (c.1495–1503), Israhel van Meckenem der Jüngere (c.1440–1503) depicts what appears to be a well-to-do couple absorbed in music-making on a positive organ (see plate 2.6).

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<sup>69</sup> See Bowles, "A Checklist of Fifteenth-Century Representations of Stringed Keyboard Instruments," plate 2.

<sup>70</sup> See above, note 10.

<sup>71</sup> On the high wrist hand position of the performer at da Besozzo's fresco, see above, p. 56.

<sup>72</sup> In two other instances of organological modification the influence of performers can perhaps be also considered as having had a determinant influence. First, the abandoning of the clavichord tuned in unison. In his 1482 *Musica Practica* Bartolomé Ramos de Pareja describes a new type of instrument incorporating strings of various thicknesses (and thus not tuned in unison any more). However, in his 1511 *Musica Getutscht* Sebastian Virdung is still reporting the existence of instruments tuned in unison. Second, the appearance of a larger compass (e.g. growing from *f''* to *g''* and *a''*) seems to speak of a building requirement prompted by the musical practice of some performers (though it appears not to be evidence of the use of this compass in the extant music of the period). See Alfons Huber, "Baugrößen Von Saitenklavieren Im 15. Jahrhundert," in *Musik Und Tanz Zur Zeit Kaiser Maximilian I.*, ed. Walter Salmen (Helbling, 1992), 157. The clavichords mentioned in this paragraph are those appearing in Leonardo da Besozzo and Perrineto da Benevento fresco in Naples (c.1433), and that found in the *Weimarer Ingenieurkunst- und Wunderbuch* (c.1520). See above, notes 9 and 13.





**Plate 2.6** Israel van Meckenem der Jüngere, *Darstellungen aus dem Alltagsleben*

The key-head of this instrument appears to be much shorter than the one the original keyboard of the clavicitherium in the Royal College of Music (c.1480) might have

displayed ( $\approx 29$  mm in length,<sup>73</sup> thus already very close to the value found in some of the extant sixteenth-century clavichords).<sup>74</sup> A lavish decoration seems also to have characterised this instrument. These two characteristics of this clavictherium suggest an ownership of a higher social status than that of the individuals depicted in van Meckenem's engraving, a condition which would have helped to create the opportunities to get in close contact with high-profile performers. These last could have informed the building and defined the characteristics of some organological elements on this instrument.

Taking all into account, it would appear that the decision to extend the length of the key head arose in the first place from the demands of the most influential performers—and, given their fame and influence, particularly from German organists. However, the effect of these demands may initially have materialized solely on instruments built under their direct supervision. This situation appears to be confirmed by Arnolt Schlick's request that both the manual and pedal keys should not be too short.<sup>75</sup> Schlick's 1511 indication hints at a possible widespread presence of a short key head in contemporary instruments. Furthermore, it is perhaps telling of the practices of some builders which, in some cases, were possibly still exploring keyboard design variants.<sup>76</sup>

Paul Hofhaimer, probably the most influential organist of the second half of the fifteenth century in matters of performance and organology, appears to have been depicted in the '*Triumphzug Maximilians*' (c.1516–1518).<sup>77</sup> In this iconographical document one can observe him at an instrument which appears to display a long key head (see plate 2.7). His hand seems to 'be held lightly and easily over the keys' and

<sup>73</sup> This is the measurement between the front edges of the key levers corresponding to  $c\sharp''$  and  $d''$ .

<sup>74</sup> E.g. at the Grassi Museum für Musikinstrumente der Universität Leipzig, cat. no. 1, 36 mm.; no. 2, 31 mm.; and no. 3, 33 mm. See Hubert Henkel, *Clavichorde, Katalog / Musikinstrumenten-Museum Der Karl-Marx-Universität Leipzig* (Frankfurt/Main Leipzig: Verlag das Musikinstrument; VEB, 1981), 21–28.

<sup>75</sup> Arnold Schlick, *Spiegel Der Orgelmacher Und Organisten, Allen Stiften Und Kirchen, so Orgeln Halten Oder Machen Lassen, Hochnützlich*, ed. Ernst Flade (Kassel und Basel: Bärenreiter-Verlag, 1951), chapter II, console specifications, 21. Schlick indicates, through the presence of a line whose length amounted that of the key, that the measurement of the natural key head was to be  $\approx 43$ –44 mm.

<sup>76</sup> Some of Schlick's recommendations—such as the care one should have with the height of the semitone keys (so that, when pressed, the key does not descend beyond the level of the natural key)—suggest that some builders might still have been struggling with the building of the new intersected-keys keyboard design for the organ. On the intersected-keys keyboard, see above, chapter 1.

<sup>77</sup> See above, note 17.

the fingers are ‘somewhat curved’. In this depiction one can also detect a quiet bodily attitude: Hofhaimer holds the ‘body and head erect and gracefully’. This depiction is probably a good reflection of the socio-culturally shaped body of an exceptional performer of the period. Moreover, it appears to reveal the influence of German organists on their Italian counterparts as it seems already to mirror what may potentially be the physical outcome of some of Diruta’s rules.



**Plate 2.7** *Triumphzug Maximilians*, plate 33 (detail)

Hofhaimer’s bodily attitude, particularly with respect to the physico-mechanical approach to the instrument, may also have been found in his pupils among whose numbers Hans Buchner is to be found. Also renowned as a performer, pedagogue and

organ builder,<sup>78</sup> Buchner left a number of fingering rules that may partly reflect the practice of his teacher as well as that of some of his colleagues. Buchner's rules and Hofhaimer's depiction, when viewed side by side, may thus offer valuable information regarding the mechanical characteristics of Buchner's playing. A subsequent comparison of some of Buchner's fingering rules with those by Santa María may possibly serve to shed some light upon some of the reasons that led performers to forsake Santa María's approach to the keyboard.

One of the clearest contrasts between the practices of Buchner and Santa María is found in the fingering recommendations for the playing of runs of consecutive quavers or semiquavers. While Buchner indicates in both cases the same fingering (e.g. a 2–3–2–3–2–3 for the right hand descending), Santa María recommends sequences such as (4)–3–2–1–3–2–1, 4–3–2–1–4–3–2–1, and 5–4–3–2–1–3–2–1.<sup>79</sup> I suggest that among the reasons explaining the origin of these contrasting practices is the individual physical basis of each of these performers' biomechanical approaches, namely, one uses a high-wrist hand position and the other a low one. Although organological conditions (e.g. the length of the key heads of a particular instrument) can substantially have affected the musical outcome while using any of the two biomechanical approaches, Santa María's fingerings suggest that the issue which obliged him to offer fingering variants is the increase in the speed of playing. This situation becomes particularly evident when one considers that he advises performers to use the fingering (4)–3–2–3–2–3–2 (i.e. the same fingering that Buchner recommends) for playing descending crotchets with the same hand.<sup>80</sup>

As I have mentioned above, the introduction of the intersected-key keyboard could have obliged performers to cram the fingers (e.g. as in the case of the organist in the Ghent altarpiece)<sup>81</sup> as this organological modification might have not been

<sup>78</sup> Hans Joachim Marx, "Buchner, Hans," *Grove Music Online* (Oxford University Press, 2012).

<sup>79</sup> Santa María offers various fingering options, except for the right hand ascending case. For this particular situation he indicates 1–2–3–4–3–4–3–4 as the only possible option. For a comparative table of the fingering practices in Spanish sources, see Lohmann, *Studien Zu Artikulationsproblemen*, 141–143.

<sup>80</sup> Santa María, *Arte*, f. 40 v. In this discussion I do not take into account the distribution of the fingers throughout the run (i.e. if the accented note is taken with a strong or weak finger).

<sup>81</sup> See above, plates 1.4 and 1.5, pp. 37–38. Incidentally, van Eyck's *pentimento* of the performer's left hand appears to have affected the original position of the thumb. Although closer examination is necessary, recent X-radiography suggests that both thumbs did not appear in the original

accompanied by an immediate lengthening of the key head. This situation appears to be confirmed by the presence of a short key in the clavichord in da Besozzo's and da Benevento's 1433 *fresco*.<sup>82</sup> But while the lengthening of the key is observed in Italy later in the century (e.g. in the Urbino intarsia), in the Low Countries, and perhaps in particular in the Burgundian territories, it might have taken longer to appear (e.g. Adriaen van Wesel's 1475–77 wood carving shows a short key-head clavichord). Notwithstanding the difficulties in trying to establish with any degree of certainty the characteristics of the Iberian keyboard during Santa María's time, it is clear that his approach was largely influenced by the use—by him or, in the circumstance that these were not available to him any more, by his predecessors—of instruments displaying the short key head. In other words, the use of a low wrist, and thus the playing practices connected with it, did not immediately recede with the introduction of the longer key head.<sup>83</sup>

Santa María's fingering 4–3–2–1–4–3–2–1 thus constitutes the solution to the problems posed by fast-run playing in conjunction with the use of a low wrist hand position.<sup>84</sup> One of the main issues behind the adoption of this solution has perhaps to do with the effect the dissimilar movements involved in finger crossing probably had on the stability of the low-wrist hand. If one considers that this effect may have

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representation. Due to the reduction of the length of the key in the final version, the left thumb appears to approach the key with the proximal rather than with the distal phalanx.

<sup>82</sup> For the implications of the adoption of an intersected-key keyboard design, see above, chapter 1, pp. 29 ff.

<sup>83</sup> Santa María seems to have encountered instruments displaying a longer key than those of his forerunners. This is suggested by his request 'to strike the key with the fleshy part of the fingertips so that the nails do not meet or touch the keys'. This would indicate that the key head on his instruments already provided enough room to accommodate the finger in this form.

<sup>84</sup> Nikolaus Ammerbach also recommends the use of the fingering 4–3–2–1–4–3–2–1 when the left hand is to play an ascending scalar movement. However, it is possible that a high wrist was already present in his playing approach. The reason behind Ammerbach's deviation from Buchner's practice—the rest of the fingerings he proposes are identical to those of Buchner—might have to do with an increase in the speed of playing of some passages. The use of 3–2–3–2 fingerings when playing fast descending passages with the left hand, and ascending and descending ones with the right one, was perhaps not to pose significant problems. However, the use of the same sequence of fingers when playing an ascending movement with the left hand probably did not work as well as in the other situations. This might have to do with a biomechanical limitation which the use of a fingering 4–3–2–1–4–3–2–1 helped to avoid. A case in point of this situation is Diruta's request to use the fingering 2–3–2–3 when playing left-hand descending scalar movements. A biomechanical issue, namely, the weakness of some fingers, is mentioned as the reason for the use of this approach. See MacClintock, *Readings in the History of Music in Performance*, 94–94. On Ammerbach's fingerings, see Elias Nikolaus Ammerbach, *Orgel Oder Instrument Tabulaturbuch: 1571/83*, ed. Charles Jacobs (Oxford: Clarendon Press, 1984), lxxxiii–lxxxvii, especially lxxxiii.

become exacerbated during the playing of fast and extended diatonic runs, it becomes clear that paired fingerings needed to be avoided.<sup>85</sup>

The crossing of the fingers<sup>86</sup> involves an alternate preparation and operation of two necessarily contrasting finger actions. For this reason, a delicate physical balance of the hand has to be attained. The contrast between the actions of different fingers has its origin in the distinct movements ensuing from each finger's position in the hand and, thus, as a consequence of the different spatial positions from which each finger's attack begins. For instance, while the third finger, when crossing over the second or the fourth, will gain its position at the following key from above the second or the fourth, when crossing over the third, will do that from below (i.e. approaching the key initially from a lower level than that of the tip of the third finger, as well as from the key's front edge). Moreover, if one stops to analyse, for instance, the movement of the third finger of the right hand crossing over the second in a descending scale one will find that the third finger would need to be forced laterally above the second finger. In contrast, the second finger will easily recover its place at the right of the third finger as a result of the release of the force that keeps the third finger above the second. As can be gathered from these observations, poor control of this technique's concomitants will certainly have an impact on the playing of note sequences (e.g. affecting articulation and, in the case of the clavichord, loudness). Moreover, achieving an even touch while using this physico-mechanical approach would be extremely difficult without the aid of other resources such as the turning of the hand (see below).

Santa María appears to have recognised that the turning of the hand in the direction of the run's movement had a stabilising effect on it when paired fingerings were in use:

[...] four things are needed to play runs in the upper and lower registers [...]. The second thing is to turn the hands a little in the direction of the run, especially when playing quavers and semiquavers.

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<sup>85</sup> This effect would have been more perceptible during the use of a playing approach in which no withdrawing of the fingertip is used (i.e. as Santa María indicates). See Santa María, *Arte*, f. 38 v.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 11.

<sup>86</sup> See above, p. 65.

But he immediately indicates that

when playing an ascending and descending run with the right hand, which is normally done with the third and the fourth fingers, the third finger should be raised, whenever it strikes the key, a little higher than the fourth, and the fourth raise no more than is necessary to release the key, so that it seems to be dragging along the keys. Moreover, this fourth finger should strike the end of the keys and the third a little further in, and the second finger should be slightly curled and higher than the third. And with the second finger in this position, it should be kept close to the third so that the hand is very strong.<sup>87</sup>

Hence, it appears that when a controlled finger action is used in combination with the turning of the dorsal side of the hand the crossing is considerably facilitated and stabilised.<sup>88</sup> This stability is in part achieved through the player's attention to both the finesse of the movement of the fingers and the place where these have to attack the key.<sup>89</sup>

Although the turning of the hand might initially have aided in reducing any potential instability of the hand during the use of paired fingerings, some performers might have found that, in certain cases, the hand-turning technique became almost inoperative during the playing of some runs. This is suggested by the fingerings that, among others,<sup>90</sup> Santa María introduces for some playing situations,<sup>91</sup> and which represent a replacement of the finger-crossing approach by a hand position switching

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<sup>87</sup> The whole passage appears in Santa María, *Arte*, part I, chapter XVII, f. 38 v.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 12.

<sup>88</sup> The magnitude of the turning of the hand seems to be suggested by Santa María's observation that 'the second finger should be slightly curled and higher than the third'.

<sup>89</sup> For sure, the impact of the turning of the hand might have varied considerably from one player and playing situation to the other. This is because various factors (e.g. the length of the fingers; the size of the hand; the elasticity of the fingers and the wrist; the size of the key width) would also have affected the manner in which this particular bio-mechanical approach was to be put into use. Harald Vogel suggests that step-over fingering 'does not give rise to a shifted paired grouping, but to a rather even articulation that can be very open with a normal hand position and more connected when the hand is turned in the scale direction [...]'. See Harald Vogel, "Playing Techniques," in *Jan Pieterszoon Sweelinck, Complete Keyboard Works, Toccatas*, ed. Harald Vogel and Pieter Dirksen, vol. 1 (Wiesbaden: Breitkopf & Härtel, 2005), 106–107.

<sup>90</sup> E.g. Juan Bermudo (*El Libro Llamado Declaración de Instrumentos Musicales*, Osuna 1555; this is the only source which recommends the use of a continuous fingering 1–2–3–4–3–4–3–4 for all playing situations); Antonio de Cabezón (*Obras de Música y Tecla para Arpa y Vihuela*, Madrid 1578; left hand ascending); Francisco Correa de Arauxo (*Libro de Tientos y Discursos de Música*, Alcalá, 1626; some instances of 'Carrera extraordinaria'); Nikolaus Ammerbach (*Orgel Oder Instrument Tabulaturbuch*, 1571/83; left hand ascending). See Lohmann, *Studien Zu Artikulationsproblemen*, 141–146.

<sup>91</sup> E.g. for the playing of fast runs with the left or right hands descending, and the left hand ascending.

approach.<sup>92</sup> The latter bio-mechanical approach incorporates a less unstable sequence of movements of the fingers; alternation is replaced by continuity by introducing (e.g. for a right hand descending run) a 4–3–2–1–4–3–2–1 finger sequence instead of a (4)–3–2–3–2–3–2 one.<sup>93</sup> Furthermore, through the use of this alternative the player can more easily avoid withdrawing the finger tip, a movement which Santa María reserves for particular situations.<sup>94</sup> This movement of the finger tends to appear, especially on the finger action of fingers 2 and 4, as a consequence of the characteristic release of these fingers in paired-fingering playing (see above, pp. 81–82).

The use of a contrasting technique in similar playing situations—e.g. Santa María suggests the following fingerings for fast notes: right hand ascending, 1–2–3–4–3–4–3–4; left hand ascending (the parallel motion), 4–3–2–1–4–3–2–1, or descending (contrary motion) 1–2–3–4–1–2–3–4—points to the idea that a skilled performer would have been able to achieve a similar musical outcome (e.g. the same articulation) when using any of these approaches (e.g. in imitative passages).<sup>95</sup> This situation offers an opportunity to reappraise the potential effect, if any, of using (correctly, if this could be said) fingerings in which neighbouring fingers cross (i.e. paired and step-over fingerings),<sup>96</sup> particularly in relation to articulation issues.

<sup>92</sup> On this technical solution, see above, pp. 64–65. Needless to say, the instability might have been exacerbated by the use of paired fingerings in conjunction with a low wrist hand position.

<sup>93</sup> Richard Troeger understands that these fingerings, found in Santa María (1565), Correa de Arauxo (1626) and Luis Venegas de Henestrosa (1557), denote the use of a ‘thumb-under’ technique, a view which is not shared by Lohmann. I tend to agree with Lohmann who points out that such a technique would have been described in detail by Santa María. See Troeger, *Technique and Interpretation on the Harpsichord and Clavichord*, 52; Richard Troeger, *Playing Bach on the Keyboard: a Practical Guide* (Pompton Plains, NJ: Amadeus Press, 2003), 210; and Lohmann, *Studien Zu Artikulationsproblemen*, 144–145.

<sup>94</sup> I.e. for the playing of repeated notes (Santa María, *Arte*, part I, chapter XVIII, f. 39 v.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 13), *quiebros* (Santa María, *Arte*, chapter XIX, f. 49 r.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 24), and *redobles* (Santa María, *Arte*, XIX, f. 49 v.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 25).

<sup>95</sup> A similar circumstance is found at a later date in Ammerbach, who indicates the use of a 4–3–2–1–4–3–2–1 fingering for the left hand ascending, while the right hand would play using Buchner’s fingerings (i.e. 2–3–2–3). See Ammerbach, *Orgel Oder Instrument Tabulaturbuch*, lxxxiv, ex. 3b.

<sup>96</sup> For a thorough discussion on the differences among these subdivisions of this fingering approach, see Harald Vogel, “Keyboard Playing Techniques Around 1600,” in *Tabulatura Nova*, ed. Harald Vogel, vol. II (Wiesbaden: Breitkopf & Härtel, 1998), 145–147.



## A first note on articulation

Although it seems that nowadays there is a growing consensus regarding the notion that any possible impact on articulation of the mechanical action of paired fingerings can be regulated,<sup>97</sup> two arguments may serve to strengthen this idea. First, in his *Fundamentum* Buchner presents his readers with fingering options for ascending and descending passages (rules 2 to 5) based on the use of the pattern 4–3–2–3–2–3 (right hand descending, left hand ascending) and 2–3–2–3–2–3 (right hand ascending, left hand descending). In rules 6 and 7 he indicates that consecutive thirds, in which both notes are of the same length, should be taken with the second and the fourth fingers (e.g. 2/4–2/4–2/4, right hand); this is to say that repeated and consecutive thirds are to be played with the same fingers.<sup>98</sup> Buchner does not make any observation, though this might have occurred during the practical lesson, as to any possible effect on articulation when a fingering using paired or repeated fingers is applied. This suggests that, when skilfully used,<sup>99</sup> any of these two types of fingerings—namely, paired (or step-over) fingerings and those involved in the playing of repeated or consecutive thirds—would produce the same basic articulation effect.<sup>100</sup> Second, Santa María does not make any observation as to any possible effect of fingering *per se* on articulation. If one assumes that he and his contemporaries cared about this issue his silence on this matter suggests that, for him, the use of contrasting fingerings during the playing of analogous musical

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<sup>97</sup> The idea that early fingerings do not necessarily have an impact on rhythm and articulation has been put forward by a.o. Richard Troeger, *Technique and Interpretation on the Harpsichord and Clavichord* (Bloomington & Indianapolis: Indiana University Press, 1987), 58; and Lohmann, *Studien Zu Artikulationsproblemen*, 336–339. Gustav Leonhardt has observed the inconsistency found in historical examples of early fingerings. He maintains that ‘[e]ven in one piece, with all the fingerings written by one person, the same motif recurring gets totally different fingerings, suggesting totally different articulations’. See Bernard Sherman, *Inside Early Music: Conversations with Performers* (New York: Oxford University Press, 1997), 199. Harald Vogel suggests that ‘with rapid note values, it is impossible to obtain a completely even articulation with these fingerings. See Vogel, “Playing Techniques,” 106.

<sup>98</sup> At times, this situation is also present during the playing of two parts by one hand: the successive notes (in diatonic or non-diatonic movement) of one of the parts tend to be played with the same finger in sequence. For examples on this matter, see Mark Lindley, “Renaissance Keyboard Fingering,” in *A Performer’s Guide to Renaissance Music*, ed. Jeffery T. Kite-Powell (New York: Schirmer Books, 1994), 189–190.

<sup>99</sup> See the discussion below on the withdrawing of the finger.

<sup>100</sup> This is what Vogel defines as the ‘das strukturierte Legato’ (the structured legato), namely, ‘the basic articulation in polyphonic keyboard writing’. See Vogel, “Playing Techniques,” 106–108, especially 107.

passages was not to provoke a significant articulation contrast.<sup>101</sup> This seems to be confirmed by the evidence found in the 1578 print, under the care of his son Hernando, of Antonio de Cabezón's *Obras de musica para tecla, arpa y vihuela*. In the section *El orden que se ha de tener para subir y baxar en la tecla* Hernando de Cabezón indicates—without making any observation as to the speed of playing—that the right hand should play with a fingering 3–4–3–4 ascending and 3–2–3–2 descending. However, for the left hand the indications are 4–3–2–1–4–3–2–1 ascending, and 1–2–3–4–3–4–3–4 descending. This situation seems to indicate that for him the use of different physico-mechanical approaches was not to elicit a rhythmic and articulation difference worthy of attention.

### The withdrawing of the finger

Keyboard playing taking as a starting point particular fingering and articulation precepts may also have been possible through the use of other specific performance practice mechanisms which allowed performers to achieve similar articulation outcomes while using contrasting fingering patterns. This seems to be confirmed by Hernando de Cabezón's remark that at some point players

[...] y despues toparan con glosas que no se podra tener esta orden de dedos, cada uno las haga con los dedos que mejor se amañare.

[...] will find glosas at which it would not be possible to preserve the suggested finger sequence [in which case] each one will have to play them with the fingers with which he can better do it.<sup>102</sup>

Cabezón's words thus suggest that an understanding existed that any physical approach could be, and would need to be, adapted according to the individual requirements of the music by means of biomechanical modification.

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<sup>101</sup> This might have also been the case in the practice of Ammerbach and Sweelinck. Sweelinck suggests the use of a paired fingering 3–2–3–2 for the right hand descending while the left hand is to play the same descending line with a step-over fingering 2–3–2–3. See the Brussel manuscript *B-Bc* 26.374/ii, quoted in *ibid.* 106, ex. 2. For the case of Ammerbach, see above, note 95.

<sup>102</sup> See Antonio de Cabezón, *Obras De Musica Para Tecla, Arpa y Vihuela*, ed. Hernando de Cabezón (Madrid: Francisco Sanchez, 1578), section 'El orden que se ha de tener para subir y baxar en la tecla'. The translation is mine. Other writers have also expressed the idea that fingerings should be adapted to satisfy the necessities of particular passages: e.g. Santa María, *Arte*, f. 41 r., Sachs and Ife, *Anthology of Early Keyboard Methods*, 14; Buchner, *Sämtliche Orgelwerke, Vol. 1*, 2; Praetorius, *Syntagma Musicum II: De Organographia*, 44.

Since individual fingerings seem to have their origin in musical considerations, organological conditions, biomechanical requirements, and physical limitations of the hand and fingers,<sup>103</sup> biomechanical modifications of a basic approach could take contrasting paths. One clear example of this is found in Santa María's physico-mechanical approach. As has been discussed above, paired fingerings involve using two finger actions that are difficult to coordinate, particularly during the playing of fast-note passages. The complexity of this playing situation appears to increase when one adds Santa María's touch instructions to the picture. He recommends striking the keys 'strongly and with good attack, which is otherwise called playing firmly [...]'. This—together with the fact that the performer has to 'strike the keys with the fleshy part of the fingertips'—adds a difficulty that could be avoided through the pressing and immediate withdrawing of the finger from the key.<sup>104</sup>

As has been mentioned, Santa María reserves the use of the withdrawing of the finger for specific occasions (see above, note 94). In any case, the solution to the problem of stability appears to be found in his indications on how to play 'cleanly and distinctly'. Here he informs his readers that in order to achieve these playing qualities

[...] two things are needed. The first and most important is that as the fingers strike the keys, the finger which plays first should be raised before the one immediately following it plays, both ascending and descending. Always proceed in this way, for otherwise one finger would catch up the next, and when one finger catches up another it follows that one note overlaps and obscures the next, which is like playing seconds, and when one note overlaps and obscures the next, it follows that the performance is messy and ragged and is without clarity and distinction.

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<sup>103</sup> On the physical limitations of the fingers, see above, note 84.

<sup>104</sup> Santa María's strong-attack requirement—reiterated in the statement that 'although the hands may be playing quietly, they should nevertheless play with a certain degree of attack' (Santa María, *Arte*, f. 38 r.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 10)—may perhaps be related to a presence of heavy actions in some contemporary keyboard instruments. This situation seems to be confirmed by Schlick's directions on the weight of the key. This should be 'playable with the fingers, not so stiff, sticky and clumsy that one should hit it with a sledge hammer or a flat iron'. See Schlick, *Spiegel*, chapter III, 22. The translation can be found in Elizabeth Irene Berry, "Spiegel Der Orgelmacher Und Organisten: a Translation and Consideration of Its Relationship to the Organ in the 17th Century" (University of Oregon, 1968), 91. The requirement of a strong attack on the clavichord has perhaps to do with some characteristics of contemporary instruments (e.g. the tension of the strings and the instrument's resonance might have imposed a necessity of using a particularly robust attack).

The second thing that is needed is to raise the finger, once it has played, only a very little above the key and not to remove it from the key under any circumstances, or bend it or curl it, which would create a lot of noise on the keys, except in the ornaments as will be dealt with in due course.<sup>105</sup>

Santa María appears then to introduce the solution to the potential problem of touch irregularity posed by the use of paired fingerings before the specific discussion on fingerings takes place. This is done by requesting the player to raise the finger that has just played before the next strikes its key. This finger action might have aided in the perception of the space between two notes, thus facilitating the introduction of the temporal balance in which the character of a basic articulation might have been based. This notion could then be seen as having helped to overcome the latent physical effect on articulation of this idiosyncratic physico-mechanical use of the hand.

Santa María's indication that the player has to raise the finger may have helped to put aside an initial need to use finger withdrawal. But his observation that the finger should not be removed from the key suggests that the practice of withdrawing the fingertip might already have been found among other performers. This is perhaps the case of Buchner who proposed the use of the fingering 2–3–2–3 for a four semiquavers turn *g-f-g-a*. This turn, which is one particular fingering case that reappears frequently during the examination of historical fingerings, is found in *Quem terra Pontus*, a piece where the precise finger to be used to play each of the notes has been painstakingly indicated by Buchner. The turn's aforementioned fingering presents the performer with an awkward physical situation which seems also to inform of some non-written physico-mechanical practices (see figure 2.4).

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<sup>105</sup> Santa María, *Arte*, f. 38 v.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 11.



**Figure 2.4 Buchner's fingering for the turn, *Quem terra Pontus*, bar 8**

Playing this turn at a moderate speed is not difficult by using Buchner's fingering and Santa María's physico-mechanical indications. However, the metrical pace given in the score suggests that the speed of the notes is high. An attempt to play the turn fast following Santa María's instructions will reveal that his proposed mechanical action cannot deliver quick notes effectively while using the suggested fingering.<sup>106</sup> It is at this point that both the use of a higher wrist and the withdrawing of the fingers during the release of the key become crucial.<sup>107</sup> The withdrawing of the finger helps particularly fingers 3 (*f*) and 2 (*g*) to reach their key without being obstructed by the finger at the side of the direction of the movement. The withdrawing movement of the finger which has already played helps thus to create the necessary space for the next finger to move laterally without having to force the pass.

From the historical information available, it is difficult to confirm the use by Buchner of this approach. However, there is iconographical evidence that appears to support the idea that both physico-mechanical approaches, namely the use of a high wrist and the withdrawing of the finger, were current. Perhaps the clearest example

<sup>106</sup> It is not clear if the hand was to be guided by the arm or laterally displaced through the aid of the wrist. I am inclined to think that Santa María, as perhaps other contemporary performers, was to choose the second approach. This idea is based on the physical-stability outcome of each of these approaches. The hand is well served by the arm when the movement is large (e.g. when playing scales). However, when the fingers have to play within a small interval the hand can help to reposition them in a more efficient way when the latter moves laterally from the wrist (i.e. with the arm spatially fixed).

<sup>107</sup> It is perhaps significant that, though more than 250 years later, Wilhelm E. Wolf recommended the use of '[t]he détaché and the slide-off' (the withdrawing of the finger or *Abglitschen*) on all the four notes of a turn. See Christopher Hogwood, "A Supplement to C. P. E. Bach's Versuch: E. W. Wolf's Anleitung of 1785," in *C.P.E. Bach Studies*, ed. Stephen L Clark (Oxford: Clarendon Press, 1988), 146.

of this situation is found in a 1648 painting by Jan Barendsz Muyckens (active 1637–1648), *Couple at the clavichord*.<sup>108</sup>



**Plate 2.8 Jan Barendsz Muyckens, *Couple at the clavichord*, Haags Gemeentemuseum, The Hague**

In this painting the performer at the clavichord can be seen crossing the fingers, aided by a lateral turning of the hand from the wrist in the direction of the movement rather than by turning it from its dorsal plane. This is to say that the dorsal surface of the hand remains almost parallel to the surface of the keyboard. This situation is confirmed by the height of the left hand's little finger at the moment in which the middle finger is about to cross the fourth finger (i.e. it is not, although it appears slightly raised, close to the level of the natural key). The use of the withdrawing of the fingers appears to be confirmed by the position on the key at which both the

<sup>108</sup> Another iconographical source documenting the use of the withdrawing of the finger is Orazio Gentileschi's and Giovanni Lanfranco's *Saint Cecilia and an Angel* (c.1617/1618 and c.1621/1627, National Gallery of Art, Washington, Samuel H. Kress Collection). In this source St Cecilia's wrists appear at different levels. That of the left hand seems to be at the same level of the surface of the natural keys. Since the elbow is held very high the wrist is bent, thus resembling the angle between the arm and the hand that would have existed in Santa Maria's approach. In contrast, the right wrist is bent in the opposite direction. This use of the hand closely resembles that in Peter Paul Rubens's own *St Cecilia* (1630's). On the issue of withdrawing in Rubens's *St Cecilia*, see below, pp. 99–100.

fourth finger of the left hand and the third of the right one are found, namely, at the key's front edge.<sup>109</sup> In this particular case the hand appears to be guided by the arm. Thus, the use of a lateral position change of the hand—i.e. shifting the position of the hand through the aid of the arm's continuous lateral displacement—in combination with the use of finger crossing in connection with finger withdrawing might have aided the performer to achieve rhythmic and dynamic evenness in playing.

Although the withdrawing of the finger was probably intended to help alleviating some of the physical effects on the stability of the hand while using paired fingerings, these effects might still have been present, in a more pronounced manner, in non-conventional fingerings. One instance is Erbach's suggestion of the fingering 3–2–3–4–3 for a sequence of notes *g-f-e-d-e* (see figure 2.5, bar 13).



Figure 2.5 Erbach, *Ricercar*, bars 13–14

The use of the fingering 3–2–3–2–3 might have helped the performer to play this line in a more comfortable manner. For this reason, Erbach's choice of fingering—considering, of course, that the indication is not the product of an oversight—points to the idea that some non-conventional fingerings might have been put into use as a result of their possibly subtle effect on articulation and timing.<sup>110</sup> This consideration

<sup>109</sup> Although the situation appears to be similar to that requested by Santa María, namely, the 'fourth finger should strike the end of the keys [...]' (Santa María, *Arte*, f. 38 v.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 12), the third finger in this source seems to be close to the edge. Santa María continues to indicate that 'the third [should be] a little further in [...]', something which, if the finger is not to be withdrawn from the key, would make it to remain closer to the keyhead's centre rather than to the edge. This seems thus to confirm that the performer at *Couple at the clavichord* withdraws the fingers while using paired fingerings.

<sup>110</sup> Unconventional fingerings might have been used precisely to produce specific effects on articulation, rhythm, and timing. The reason behind the possibly different effect of these fingerings on these components of performance might have to do with their infrequent practical use, a situation which could have made players to handle them in a less dexterous form. This circumstance would have had an impact on their potential effect, even when using finger withdrawing, to counteract the physical outcome of particular biomechanical approaches. Mark Lindley has suggested that the use of

appears also to indicate that the withdrawing of the finger, if in fact present in the practice of performers of his time, might have already been used in a systematic form: the potential physical difficulty involved in Erbach's fingering would suggest that the withdrawing of the finger might have been aimed at facilitating the use of a physico-mechanical approach (i.e. the use of paired fingerings) rather than to serve the purposes of articulation equalization.

For sure, the use of those fingerings recommended by Buchner could have produced 'an effect not unlike *notes inégales*'.<sup>111</sup> A specific instance in which the use of conventional fingerings might have had an impact on the rhythmic evenness is a passage in the tenor in Buchner's *Quem terra Pontus* (bar 4) (see figure 2.6).

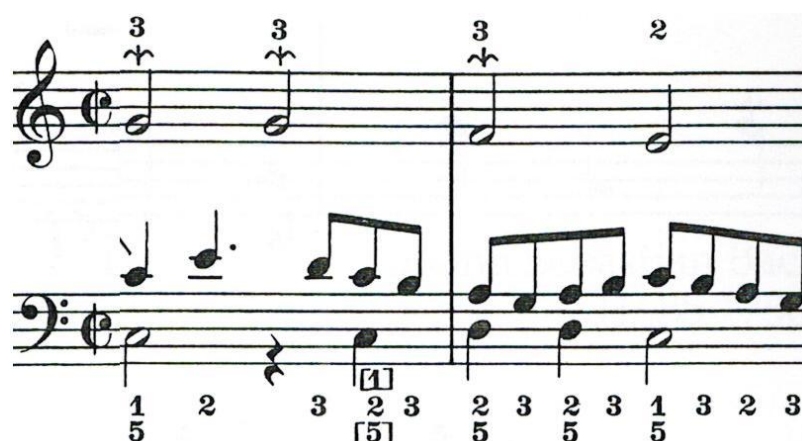


Figure 2.6 Buchner, *Quem terra Pontus*, bars 4–5<sup>112</sup>

It is probably clear that the conjectural outcome of a historical techno-mechanical approach will be substantially modified by the larger or lesser number of aspects we decide are involved in its practice. Thus, when the use of the withdrawing of the finger is included in the picture the rhythmic outcome resulting from the action of the fingers—as defined by their mechanical action during this particular playing situation—could be lessened or even inhibited. That the use of this physico-

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the fourth finger on *d* 'gives rise to a cadential rubato and a relatively deliberate articulation'. This might still have been the case when the withdrawing of the finger was introduced. Although Lindley suggests that a convincing musical effect can be achieved if 'the hand is managed suitably', he does not provide details as to how to control the hand. See Lindley, "Renaissance Keyboard Fingering," 192–193 and 199.

<sup>111</sup> See *ibid.* 191.

<sup>112</sup> One should consider that the indication to use the second finger on the second *c* in bar 4 is most probably a mistake. This note should be taken with the thumb. Figures 2.4–2.6 are taken from Lindley and Boxall, *Early Keyboard Fingerings: A Comprehensive Guide*.



mechanical approach extended also to the action of the thumb seems to be confirmed by the presence of characteristic wear on the front edge of the key in some historical instruments.<sup>113</sup>

### **From striking to pressing: pressing and withdrawing**

When one concedes that finger withdrawing was present during the playing of Buchner's turn, described above, one may be in the position to build a compelling case for the use of this playing resource in other situations. As I have suggested, the use of the withdrawing of the finger might have facilitated the playing of fast runs when the fingering 2–3–2–3 (right hand ascending) was put into use. But, of course, it is also possible that in order to facilitate the use of these particular fingerings performers may instead have resorted to the aid of alternative physico-mechanical resources such as the turning of the hand. Moreover, the effectiveness of one approach (e.g. the turning of the hand) might have been greatly increased if used in combination with another one (e.g. a position of the wrist that matches the level of the natural keys).

The combination of the two approaches exemplified above permitted performers to play the natural key by using the side of the finger's cushion; this could have helped to enlarge the finger's area of contact with the key, thus assisting in the finger's control over the key. In any case, it appears that two circumstances were probably to play in favour of the establishment of the withdrawing of the finger as a pre-eminent playing resource. First, the third finger's<sup>114</sup> natural tendency to withdraw during the use of paired fingerings—as a consequence of the biomechanical characteristics involved in this technique (see above, pp. 82–84)—particularly during the performance of fast-note runs. Second, the player's growing awareness of the possible effect on performance of the use of the withdrawing of the fingers during scalar movement, namely, its probable impact on the evenness and clarity of rhythm and articulation.

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<sup>113</sup> On this issue, see chapter 5, pp. 206 ff.

<sup>114</sup> Or the fourth, when the fingering 3–4–3–4 was put into use.

The regular use of the withdrawing of the finger during the playing of scalar movement appears to have had a further effect on the mechanical approach of some performers. In the first place, the amount of the turning of the hand seems to have gradually decreased. This is clearly observable in Muyckens' *Couple at the clavichord* where the performer's hands appear to be using paired fingerings without the aid of this resource. Finally, the withdrawing of the finger appears to have brought into the picture another biomechanical element, namely, the inner bending of the finger's first joint. The presence of this biomechanical characteristic appears to be confirmed by the shape of the performer's fingers seen in some depictions such as *The Five Senses* (c.1595–1600), a series of engravings by Jan Saenredam (1565–1607) based on drawings by Hendrick Goltzius (1558–1617).<sup>115</sup> In the representation of the ear it is possible to observe a lady playing the clavichord, the second finger of the right hand clearly bent above the key.<sup>116</sup>

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<sup>115</sup> In the collection of the Museum Boijmans van Beuningen, Rotterdam, The Netherlands.

<sup>116</sup> I am considering the image as viewed in the engraving (i.e. the mirror of the original drawing). Although Goltzius was careful to depict the arm of the lute pointing to the right (so that in the engraving it appears to be at the left side of the lute player), it is unclear, given the action of the hands, if he took the same care when depicting the lady's hands.



**Plate 2.9 Hendrick Goltzius, *The ear*, Museum Boijmans van Beuningen, Rotterdam**

When a playing approach in which the key is pressed and the finger withdrawn is put into use the first joint could tend to bend. The recommendation to press the key—as well as a discussion on its effects—has been put forward by Diruta in *Il Transilvano*.<sup>117</sup> Diruta's view appears to be in response to the approach in which the key had to be struck—not to be confused with that suggested by Santa María (see below, note 119)—a technique, in Diruta's view, not suited for playing on the organ.

<sup>117</sup> See Diruta, *Il Transilvano*, 4 v.; MacClintock, *Readings in the History of Music in Performance*, 88 and 90.

## A second note on articulation

Diruta recommends that ‘the fingers should press the key and not strike it, and the fingers should rise as much as the key rises’.<sup>118</sup> When these two actions are put into use at the same time a basic articulation principle appears to be the necessary outcome.

For Diruta leaping and striking are approaches reserved to the playing on plucked instruments.<sup>119</sup> When playing the organ the performer should keep his fingers close to the surface of the key. One of the consequences of this approach is that the time between the release of the key and the attack of the following one can be reduced, something which Diruta indicates as necessary in order to prevent that the voices sound ‘like a person who takes a breath after every note in singing’.<sup>120</sup> Hence, the maximum height the fingers will ideally have to reach is that marked by the key at its rest position. From this rationale, a basic articulation principle in organ playing (if indeed there was one for Diruta) may be extracted. This principle appears to be conveyed by Diruta’s observation, denoted in terms of a sound image model, about the consequence of the use on this instrument of a physical approach better aimed at the performance on quilled instruments.<sup>121</sup>

The instrument’s mechanics plays a determinant role in the shaping of articulation. On the harpsichord the temporal space among notes is determined by the moment in

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<sup>118</sup> Ibid. 88.

<sup>119</sup> Ibid. 91. There is a critical difference between the striking described by Diruta and that proposed by Santa María, namely, Santa María requests that the fingers are kept as close as possible to the key: ‘[Do not] strike the keys from a height, and so the fingers must be kept near the keys, and after each finger has struck the key, raise it very little’. (Santa María, *Arte*, f. 38 r.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 11); The distinction has its origin in the characteristics of the instruments to which each of these authors are referring to, namely, quilled instruments (Diruta), and the clavichord and the organ (Santa María). Santa María advises also not to raise the fingers since the ‘time taken in raising and lowering the fingers overmuch detracts from the time that the notes should be sounding, with the fingers kept on the keys’. This statement suggests that Santa María’s ideas on articulation at the organ were indeed very close to those of Diruta (see this and the following paragraph). Santa María’s observations have probably to do with the practice of some performers who might still have been using an exaggerated movement of the arm when playing on the organ (e.g. one similar to that found in the depiction in the *Rutland Psalter* of King David playing the organ. See Perrot, *The Organ*, XVII, 2.

<sup>120</sup> See Diruta, *Il Transilvano*, 5 r.; MacClintock, *Readings in the History of Music in Performance*, 90.

<sup>121</sup> According to Diruta there are two reasons why leaping and striking are desired when playing on quilled instruments, namely: 1) the keys of these instruments ‘must be struck in order for the jacks and the quills to play better’; 2) this approach helps ‘to play the dances with grace in that style’. Ibid. 91.

which the damper falls above the string and that in which the quill plucks the string of the next note.<sup>122</sup> The length of the temporal interval between these two situations might also depend on the time that the performer's finger takes to reach the surface of the following key once the first key has been released. That is to say that if the finger is raised the amount of time would in part be defined by the moment in which the second finger starts its rising movement; by the maximum height the performer finds it necessary to reach before lowering the finger to strike the next key; and by the finger's ascending and descending speed.

On the organ, where the principle noted above would have been similar, the basic articulation is defined by the moment at which the sound of the first note ceases—i.e. during the key's release and at the moment in which the pallet closes—and the moment at which the pallet of the next key begins to open. Since Diruta recommends the player not to raise the fingers beyond the maximum height of the key (i.e. the finger has to remain as close as possible to its surface) the time of the articulation is defined by the closing and opening of the pallets and, probably, the time the first key needs to reach its rest position.<sup>123</sup> It is then that the second finger was probably to press its key.<sup>124</sup> This physico-mechanical approach would have prevented the presence of a large time interval between notes while keeping them clearly separated.

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<sup>122</sup> I am considering the playing situation in which the key of the second note is played once the first one has been released. Santa María demands that 'the finger which plays the first key should be raised before the one immediately following it plays, both ascending and descending [...] otherwise one finger would catch up the next' with the consequence that 'the performance is messy and ragged and is without clarity and distinction'. See Santa María, Santa María, *Arte*, part I, chapter XVI, f. 38 v.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 11. Compare with Jean-Philippe Rameau's indication that '[f]rom the finger with which you started, pass on to its neighbour and so on from one to the other, taking care that the finger which has just depressed a key is raised from it in the same instant as its neighbour depresses another, for the raising of one finger and depressing of a key by another must be carried out simultaneously'. See Jean-Philippe Rameau, "De La Mécanique Des Doigts Sur Le Clavessin (1724)," in *Pièces De Clavecin*, ed. Erwin R. Jacobi (Kassel: Bärenreiter Kassel, 1972), 17.

<sup>123</sup> Diruta does not indicate, as Santa María does, if the second key has to be played once the other has been released. Thus, it is not possible to ascertain the amount of time between notes, since if the second finger starts to play the key before the previous one has been released completely it would be possible, to a certain extent, to 'tie' the notes.

<sup>124</sup> In earlier times the basic articulation might have been characterised by longer time intervals. This is what might be concluded from a review of some examples of thirteen- and fourteen-century iconography. In some cases performers seem to have raised not only the finger but the whole arm. (e.g. King David in the *Rutland Psalter*. See above, note 119). This situation would have helped to create long silences among notes which might have passed more or less unnoticed when the organ sounded next to a choir.

## From striking to pressing: pressing, withdrawing and its consequences

Playing approaches in which the key is to be pressed rather than struck might have been in currency for some time before Diruta's 1593 recommendation. The use of this manner of attacking the key may in part be confirmed by the presence in iconography of the bending of the finger's first joint. Goltzius is perhaps one of the last during the sixteenth century to depict this characteristic of the playing finger. Earlier sources in which this bending can be observed are van Hemessen's *Young woman playing a clavichord* (c.1575), and *The clavichord player*,<sup>125</sup> an engraving by Cornelisz Vermeyen (1500–1559) (see plates 2.10 and 2.11).



**Plate 2.10 Jan Sanders van Hemessen, *Young woman playing a clavichord*, Worcester Art Museum, Worcester, Massachusetts**

<sup>125</sup> In this engraving, the player is shown using a low wrist position, something which would place her playing approach closer to that of Santa María.



**Plate 2.11 Jan Cornelisz Vermeyen, *The clavichord player***

Relying solely on this evidence it would be difficult to try to establish if the pressing of the key was a constant in the techno-mechanical approach of performers from the sixteenth century onwards. However, the fact that the bending of the finger can be seen in various iconographical sources suggests that a considerable amount of finger pressure was indeed exercised by some performers.<sup>126</sup>

The presence in iconography of the bending of the finger seems also to indicate that painters might frequently have observed it in their performer models. Artists may then have felt impelled to incorporate this characteristic of the finger into their works, particularly if a conviction existed that its depiction would aid in the

<sup>126</sup> Diruta requests the key to be pressed (*premano*). However, he is not specific as to the amount of pressure. Some performers might have felt impelled to increase it when playing on instruments whose touch was particularly heavy (e.g. clavichords with a too-high string tension, or harpsichords heavily quilled). This argument is suggested by the bending of the fingers in van Hemessen's *Young woman playing a clavichord*. In this painting the fingers seem to be pressing the key with excessive force. This was perhaps as a result of the additional energy necessary to play chromatic keys in an instrument with a short key ratio and, perhaps, high string tension. On the impact of the key's ratio on touch, see chapter 3, p. 141.

production for the viewer of an impression similar to that of an actual performance and its aural output.<sup>127</sup> This is perhaps what took Peter Paul Rubens (1577–1640) to depict *St. Cecilia* (1630s)<sup>128</sup> with a right hand showing a clearly bent second finger joint (see plate 2.12). However, if one considers the seemingly relaxed appearance of the hand and fingers the bending of the joint might be an indication of its suppleness and a particular lightness in playing rather than of excessive pressure on the joint (see below).

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<sup>127</sup> In a 1616 engraving, Tobias Maurer depicts an ensemble performing in the interior of Augsburg Cathedral. The organist (perhaps Christian Erbach) is portrayed playing with very high wrists, a possible indication of his role as a conductor of the ensemble. This image can be found in Adolf Layer and Friedhelm Brusniak, “Augsburg,” *Grove Music Online* (Oxford University Press, 2012).

<sup>128</sup> In the Gemäldegalerie, Berlin. The composition in this painting, as well as that by Abraham van Diepenbeeck (see below, note 138) seems to be based on Michiel I Coxcie’s (1499–1592) *Saint Cecile* (1569), in the Museo del Prado, Madrid. Rubens made a number of important changes in the composition while painting this work. A number of them resulted from Rubens’s decision to extend the original panel to the left by adding an extra piece of wood. This situation forced Rubens to repaint the original instrument, probably an organ (of which only the front section was originally visible), as a plucked instrument (the tuning pins appear to be an addition resulting from this transformation). The revision of the composition also required to move the instrument’s left edge to the left of the panel, something which was to help to reveal the originally-hidden right hand. As a result of these changes, the left hand in the final version seems to be positioned unusually far away from the instrument’s front. Despite this problem, and given the presence of a sketch of this hand, it appears that the final shape of the right hand was well pondered, and probably corresponded to that found in performers of the period. A hand given the impression of actual playing might have helped to take the viewer’s attention away from some of the inconsistencies of the composition. For a thorough analysis of this repainting, see Rüdiger Klessmann, “Rubens’s Saint Cecilia in the Berlin Gallery After Cleaning,” *The Burlington Magazine* 107, no. 752 (1965): 548, 550–559, especially 557–558.





**Plate 2.12 Peter Paul Rubens, *St Cecilia*, Gemäldegalerie, Berlin**

Nevertheless, a slightly higher pressure than that necessary to play the key might have been used by some performers. In *A Young Woman playing a Harpsichord to a Young Man* (probably 1659), Jan Steen depicts a fairly bent joint of the right hand's second finger (see below, plate 5.10, p. 204). Although the bending might not be readily apparent to some, it is clear that the shape of the fingers is not that required by Diruta, namely, with the fingers bent. This way of playing is perhaps one among the reasons behind the presence of some particularly long grooves in the surface of

the chromatic keys in some seventeenth-century instruments (see chapter 5, pp. 204–205 and 241 ff.).

## French and German practices

In *Les principes du Clavecin* (1702) Monsieur de Saint Lambert indicates that players should not raise ‘the fingers too high while playing and not pressing too hard on the keys’.<sup>129</sup> When this recommendation is looked at next to the evidence regarding the pressing of the finger (see above) one might be inclined to think that although some able performers urged avoiding the use of excessive force when pressing the key—particularly in the case of beginners—others appear to have made a request for an extra striking force. Certainly, this excessive force may also have been the result of a bad playing habit (see the discussion below on Carl August Thieli). But the presence of the bent joint could also mean that next to the necessary force to press the key—and to keep it down, particularly in the case of the clavichord—a suppleness and relaxation of the finger was also present. These are two characteristics of the finger that seem to have become typical in the physico-mechanical approach of some seventeenth-century performers. One of the clearest examples of this situation is perhaps Sieur de Chambonnières (1601/2–1672), a performer who is praised by Marin Mersenne (1588–1648) for his ‘lovely melodies and fine accompanying parts mingled together, beauty of rhythm, fine touch [and] lightness and speed of hand’.<sup>130</sup> Chambonnières’s approach appears then to be closely related to that of François Couperin (1688–1733) who, in his *L’art de toucher le Clavecin* (1717), not only emphasises the importance of ‘suppleness and great freedom of the fingers’ above force. He also outlines the necessary instrument’s touch conditions to acquire them:

On ne doit se servir d’abord que d’une épinette, ou d’un seul clavier de clavecin pour la première jeunesse; et que L’une, ou L’autre soient emplumés très foiblement; cet article étant d’une conséquence infinie, La belle exécution dépendant beaucoup plus de la souplesse, et de la grande Liberté des doigts, que

<sup>129</sup> ‘[...] n’appuyant point aussi trop fort sur les Touches’. Monsieur de Saint Lambert, *Les Principes Du Clavecin* (Paris: Christophe Ballard, 1702), 42; Michel de Saint-Lambert, *Principles of the Harpsichord by Monsieur de Saint Lambert*, ed. and trans. Rebecca Harris-Warrick (Cambridge: Cambridge University Press, 1984), 74.

<sup>130</sup> See David Fuller, “Chambonnières, Jacques Champion, Sieur De.,” *Grove Music Online* (Oxford University Press, 2012).

de la force; en sorte que dès Les commencemens sy on Laisse jouer un enfant sur deux claviers, jl faut de toute nécessité qu'il outre ses petites=mains pour faire parler les touches; et delà viennent les mains mal=placées, et la dureté du jeu.

A spinet or a one-manual harpsichord should be used with the very young; and whichever it is should have soft quills;<sup>131</sup> this is a matter of very great importance, since beautiful playing depends much more on the suppleness and great freedom of the fingers than on force; thus from the very beginning, if a child is allowed to play on a two-manual instrument, he is obliged to force his little hands to make the keys speak, resulting in badly placed hands and hardness of tone.<sup>132</sup>

For his part, Jean-Philippe Rameau (1683–1764) advises his readers

[n]'appesentissez jamais le toucher de vos doigts par l'effort de votre main; que ce soit au contraire votre main qui en soutenant vos doigts, rende leur toucher plus léger [...]

[n]ever [to] make the touch of your fingers heavy by the effort of your hand. On the contrary, let it be your hand which, by supporting your fingers, makes their touch lighter [...]<sup>133</sup>

This instruction suggests that the force applied through the finger's action is controlled from the knuckle, something that is emphasised by Rameau's explanation of the finger's biomechanics:

Le mouvement des doigts se prend à leur racine, c'est-à-dire, à la jointure qui les attache à la main & jamais ailleurs [...]

The movement of the fingers begins at their root, that is to say, at the point where they join the hand, and never anywhere else [...]<sup>134</sup>

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<sup>131</sup> Compare this recommendation with that of, among others, Carl August Thielo who favoured, in the case of beginners, the use of the clavichord in place of the heavier organ or harpsichord. Couperin's lightly-quilled instrument would have placed the touch of a harpsichord closer to that of a clavichord. In other words, the use of very light quilling would have minimised the resistance the finger had to overcome. In this form the touch would have almost resembled that of a clavichord (i.e. where the free fall of the finger is favoured). This might have been intended to create an awareness of the finger's weight and the knuckle's role in the moving, control and support of the finger. On this issue, see also the discussion of J.S. Bach's technique in chapter 4.

<sup>132</sup> François Couperin, *L'Art De Toucher Le Clavecin*, Facsimile (Paris, 1717), 6–7; English translation in David Tunley, *François Couperin and "the Perfection of Music"* (Aldershot: Ashgate, 2004), 136.

<sup>133</sup> Rameau, "De La Mécanique Des Doigts," 17. The English translation is taken from the same publication.

<sup>134</sup> Ibid. 17–18.

This force is made up of the energy applied by the player, the weight of the finger, and the finger's natural tendency to retract:

Il faut que les doigts tombent sur les touches & non pas qu'ils les frappent; il faut de plus qu'ils coulent, pour ainsi dire, de l'un à l'autre en se succédant: ce qui doit vous prévenir sur la douceur avec laquelle vous devez vous y prendre en commençant.

The fingers must drop on to the keys and not hit them: moreover, they must glide, so to speak, from one key to the other when playing successive notes, which will give some idea of how gently one has to start.<sup>135</sup>

The presence in the beginner of this gentleness (*douceur*), which may be derived from the suppleness of the wrist,<sup>136</sup> seems to mark the way to the acquisition of the necessary suppleness and lightness that appears to be required by the style of playing of a number of performers: Chambonnières, Saint Lambert, the Couperin clan, some of their followers, and, probably, Johann Sebastian Bach.

Couperin's recommendation to use a lightly-quilled instrument in the case of beginners seems then to imply that a number of French keyboard players would have quilled their instrument in such a way that the force necessary to pluck the string was to be somewhat larger than the one produced by the mere weight of the finger. This is to say that Couperin's light-quilling set up corresponds to the physical needs of the beginner, probably a child, and that the larger the weight of the fingers of an adult the heavier the quilling of the instrument. A more precise characterization of the lightness or heaviness of this quilling would be, however, difficult to establish since the specifics of quilling were probably defined by some very subtle needs of each performer. Among these are those derived from his or her particular corporal characteristics (i.e. the peculiarities of his or her constitution) and the degree of nuance in the corporal control. In any case, the written evidence suggests, at least in the case of the influential group of performers named above, that the quilling's

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<sup>135</sup> Ibid. 17.

<sup>136</sup> 'The wrist must always be supple. This suppleness, which is then transmitted to the fingers, gives them all the ease of movement and all the lightness necessary [...]' Ibid. 17.

resistance may have been so regulated as not to put excessive force demands on the performer's fingers.<sup>137</sup>

In spite of the evidence presented above it is probable that a high amount of finger pressure was frequently used by a large number of performers. This argument is based on an observation of the wear evidence present on the surface of the keys of some historical instruments.<sup>138</sup> The use of this evidence, as I will argue in chapter 5, is quite problematic. But, at this point, one can use a basic premise to try to understand the issue of finger pressure starting from the perspective offered by this type of physical evidence. If one would like to draw a more precise picture about the abrasion process's time-use relationship (i.e. a process in which the finger's flesh and the key top's material are involved) one would need to try to establish, first, the amount of time that some of these instruments have been played on a daily basis; second, their approximate life span; and finally, the particular manner in which the instrument was used.<sup>139</sup> Yet, one can also begin with a comparison of this evidence with that found in contemporary instruments, particularly those present at music schools and universities where these instruments are in constant use, at times for more than ten hours a day. When the wear present on the keyboards of both groups is compared one may tend to suggest that some historical instruments might have been subjected to a quite heavy playing schedule. Furthermore, given the amount of wear present on historical instruments, and its meagre presence in modern ones, the pressure placed on the key during the sixteenth up to the middle of the eighteenth centuries seems indeed to have been quite high. Finally, it is difficult to estimate the precise time an instrument has been played. However, the worn out surface of the key could have appeared in a relatively short time.

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<sup>137</sup> The touch characteristics required by Emanuel Bach include a consideration of the weight of the key, which should offer some resistance to the finger. At the same time, the weight of the jack should be that which would help to raise the finger once the latter has been relaxed. However, the lightness of the quilling might have been close to that preferred by players of the French school. See Bach, *Versuch*, Introduction, § 13. On some possible implications of the balance of this variables, see chapter 3, p. 117.

<sup>138</sup> This evidence seems to be also present in iconography. See, for example, Abraham van Diepenbeeck's (1596–1675) *Saint Cecilia*, The Metropolitan Museum of Art, New York. The keys in this painting, particularly the chromatic ones, show a worn-out surface. On the origin of the composition depicted in this painting, see above, note 128. A detail of this image can be seen in chapter 5, plate 5.9, p. 203.

<sup>139</sup> It would be difficult to try to understand these processes without carrying out a more specific study which hopefully will be undertaken in a near future. See also chapter 5, p. 202.

Pressing the key with excessive force may have been a playing tendency of a significant number of professional performers. This is what seems to lie behind a 1746 statement by Carl August Thielo's (1707–1763) indicating that

[s]ome keyboard players cannot touch a key on the clavier without a bad habit of having to press it so that the most cheerful pieces sound like laments ['lamentabile']. Many organists use this touch also on the organ from habit, but pointlessly, since the organ sounds no better for it.<sup>140</sup>

The reason for this tendency is not easy to explain. However, a few significant points related to it are important to note. Since the striking of the key seems to have been definitively abolished by the time Thielo published this treatise, the use of an excessive force when pressing the key might have been partly a result of a deficient handling of the instrument. This situation may have had its origin in either a defective teaching of the clavichord's touch or the use of a heavier organ or the harpsichord (with an unsuitable touch for a beginner) for teaching the principles of keyboard playing. The result in both cases might have been that in order to overcome the key's resistance some players felt impelled to press the key with excessive force. In the case of the clavichord this situation might have been aggravated by the need to maintain the string's sounding, something which, depending on the tension of the strings, could once more have encouraged players to press the keys with too much force. As a result of this, the performer's suppleness, lightness and agility in playing were to become hindered. It is then probably not surprising that Thielo, as well as a significant number of pedagogues before and after him, recommends in his 1753 German treatise *Grund-Regeln wie man, bey weniger Information, sich selbst die Fundamenta der Music und des Claviers, lernen kan* (p. 32) that

[e]in Anfänger übe sich erst auf dem Claviere, denn will er anfangs auf Spinnetten, Flügeln oder Positiven spielen, welche hart zu greifen seyn, so wird er sich ein rauhes und hartes Spielen angewöhnen.

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<sup>140</sup> In Carl August Thielo, *Tanker Og Regler Fra Grunden Af Om Musiken, For Dem Som Vil Lære Musiken Til Sindets Fornøjelse, Saa Og for Dem Som Vil Gjøre Fait Af Claveer, General-Bassen, Og Synge-Kunsten* (Copenhagen: Johann Christoph Groth, 1746), quoted in Christopher Hogwood, "The Copenhagen Connection: Resources for Clavichord Players in Eighteenth-Century Denmark," in *De Clavicordio V: Proceedings of the International Clavichord Symposium, Magnano, 5–8 September 2001*, ed. Bernard Brauchli, Alberto Galazzo, and Ivan Moody (Magnano: Musica Antica a Magnano, 2002), 257. The original Danish text is not given in this publication.

[a] beginner should first practice on the clavichord, because if he should start playing on the spinet, or harpsichord or positive organ which are harder to play, he would become used to a rough and hard manner of playing.<sup>141</sup>

This need to emphasise the use of the clavichord might have its origin in the beginner's physical needs, particularly those of a child. But I find this recurrent insistence on the necessity to use the clavichord, or, in its case, a light-touch instrument, as a probable indication of the failure of a significantly large number of keyboard instructors to follow this principle in order to avoid acquiring a heavy touch.<sup>142</sup> That the use of a light-touch instrument was indeed intended seems to be confirmed by Wilhelm Friedrich Marpurg (1718–1795) who in his 1751 *Die Kunst das Klavier zu spielen* recommends that, in the beginning, very young people should use either a clavichord, spinett or a lightly-quilled single register harpsichord.<sup>143</sup>

Thielo's recommendations might have mirrored those of Johann Gottfried Walther (1684–1748) with whom he studied in Weimar. In the *Clavicordo* entry of his *Musicalisches Lexicon*, Walther describes the instrument as 'every player's first *Grammatica* [...]'.<sup>144</sup> He carries on by telling his readers that by gaining command of the necessary skills to play on it the player would consequently get on well with other keyboard instruments. It is thus in this form that the use of a heavy touch on the organ is avoided. Another aspect which Walther might have instilled in his pupil was the particular use of the thumb, one which appears to link Thielo in a more direct way to the practice of J.S. Bach:

When the student begins to play the clavier he must get used to holding his fingers rather more bent than stretched out. Note that above all, the thumb must be held close to the index finger, in the course of playing mostly under the index finger. The thumb may well come to be used in playing and not (as some antiquated players teach) to play with the four fingers without the thumb.<sup>145</sup>

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<sup>141</sup> Quoted in *ibid.* 258.

<sup>142</sup> This seems to be one of the most important reasons behind the large number of recommendations to use the clavichord as the instrument where to teach beginners.

<sup>143</sup> See Friedrich Marpurg, *Die Kunst Das Klavier Zu Spielen* (Berlin: Haude und Spener, 1751), 6, § 5.

<sup>144</sup> See Johann Gottfried Walther, "Clavicordo," ed. Friederike Ramm, *Musicalisches Lexicon, Oder Musicalische Bibliothec* (1732) (Kassel: Bärenreiter-Verlag, 2001), 157 (1732: 169–170).

<sup>145</sup> Quoted in Hogwood, "The Copenhagen Connection," 255.

Thielo's observations convey the impression that there are grounds to think that a number of German performers used a characteristically light touch. Among these performers one can perhaps include both Walther and his cousin J.S. Bach.<sup>146</sup>

Given Bach's close relation to French music performance and, probably, other influential socio-cultural aspects of the French society, the characteristics of his touch might in some respects have resembled those present among contemporary leading French performers. This view is also supported by aspects related to the organological characteristics of some keyboard instruments that Bach might have come across during his life (e.g. those by Michael Mietke (d. 1719)). In the following chapters I will thus explore more specific aspects of Bach's possible approach to the keyboard while considering his socio-cultural milieu, side by side with an introductory analysis of the evidence of wear present on historical keyboard instruments.

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<sup>146</sup> For a discussion on some aspects of Bach's touch, see chapter 3, pp. 139 ff., and chapter 4.



### 3 Mechanism and expression: an inquiry into J.S. Bach's touch

An understanding of Johann Sebastian Bach's keyboard touch necessarily begins with an interpretation of those historical documents in which some of its defining characteristics seem to have been preserved. In spite of a number of descriptions of his playing being available, a visualisation of Bach's playing practices is difficult. This is in part a result of the interpretation problems posed by the sources which, in many cases, are not easy to elucidate. Moreover, these problems are aggravated when some of the sources are read, sometimes uncritically, side by side.

Three sources of information have held centre stage in the search of Bach's touch: Johann Joachim Quantz and Carl Philipp Emanuel Bach's influential 1752 and 1753 treatises, and Johann Nikolaus Forkel's 1802 biography of J.S. Bach. Quantz and Forkel provide their readers with robust descriptions of how J.S. Bach seems to have, in some instances, operated physically at the keyboard. On the other hand, Emanuel Bach advances a description of the characteristics of touch required on the clavichord, which Forkel considered laconic but ineffective, without expressly referring to his father's practices. Although Forkel is writing without the benefit of Quantz's direct observation of Bach's playing, he is taken to associate Emanuel Bach's 'distinctness in the touch' to that of his father.<sup>1</sup>

Emanuel Bach observes in the *Versuch* that his remarks on fingering reflect J.S. Bach's practice. However, in the case of touch no mention is made to his father's views.<sup>2</sup> I suggest that this circumstance indicates that, although there might have been some principles regarding touch that father and son could have shared, the particular historical position of each was to call for idiosyncratic performance approaches. An awareness of the various touch necessities demanded by particular instruments and contemporary musical idioms might have led Emanuel Bach to offer a schematic description of the basic elements of touch. Moreover, he might have

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<sup>1</sup> Johann Nikolaus Forkel, *Ueber Johann Sebastian Bachs Leben, Kunst Und Kunstwerke* (Leipzig: Hoffmeister und Kühnel, 1802), Ch. III, 12.

<sup>2</sup> Bach, *Versuch*, Ch. 1, Fingering, § 7 and 8.

considered that a more nuanced discussion of its particulars had to find its place in the practical lesson rather than in the body of a treatise. Seen under this light, the consequences of Forkel's association are probably not difficult to foresee, particularly when one takes into account that Emanuel's views regarding keyboard performance seem to have gone through considerable revision during the years preceding the writing of the *Versuch*.

Despite evidence that Forkel's description of Bach's touch is mainly based on the ideas received from Quantz's treatise and Bach's eldest sons Wilhelm Friedemann and Carl Philipp Emanuel, Quantz and Forkel's descriptions have often become linked, something which may lead to problematic assumptions.<sup>3</sup> This situation calls for a thorough review of these sources. This chapter will then revisit some of the more problematic passages in these texts related to the idea of a Bach touch. Particular attention will be given to the finger action during the release of the key. In the end, it is expected that an analysis of these sources will offer sufficient information to outline the character of some of the basic elements that might have been present in Bach's physical approach to the keyboard.

## Playing the clavier

In the opening of the third chapter of his biography of Johann Sebastian Bach, Johann Nikolaus Forkel observes that:

Joh. Seb. Bachs Art das Clavier zu behandeln, ist von jedem, der das Glück gehabt hat, ihn zu hören, bewundert [...] Daß dieses [...] Clavierspielen von der Art, wie das Clavier von Bachs Zeitgenossen und Vorgängern behandelt wurde, sehr verschieden gewesen seyn müsse, ist leicht zu begreifen; aber bis jetzt ist noch von Niemand genau angegeben worden, worin diese Verschiedenheit eigentlich bestanden habe.

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<sup>3</sup> E.g. David Ledbetter suggests that Forkel's idea that Bach's '[...] 'peculiar mode of touching the instrument' [...] is the curious scratching touch first described by Quantz (1752) as special to Bach [...]'. See David Ledbetter, *Bach's Well-tempered Clavier: The 48 Preludes and Fugues* (New Haven and London: Yale University Press, 2002), 131. An association in these terms overlooks the differences between both sources in relation to the amount of the withdrawing of the fingers, the particular circumstances in which it is to be used, and its possible impact on performance.

Johann Sebastian Bach's manner of handling the *clavier* was admired by all those who had the fortune to hear him [...] That this form of *clavier* playing [...] must have been very different from the form in which Bach's contemporaries and predecessors handled the *clavier*, is easy to recognise. Nevertheless, hitherto nobody has precisely stated in what this difference had actually consisted.<sup>4</sup>

Forkel carries on pointing out that one of the central issues for a consummate performance was the distinctness of the notes (*Deutlichkeit der Töne*) a quality of playing which could be gradated and which arises from 'the form of touching the instrument' (*Die Art des Anschlags*).<sup>5</sup> He considers that the possession of the particular touch producing the highest degree of distinctness in performance was what distinguished the playing of the Bachs from that of other performers.

For Forkel, the 'highest degree of clearness' (*den höchsten Grad von Deutlichkeit*)<sup>6</sup> when playing individual notes will result in the listener's attention being entirely devoted to the 'ideas and their connection' (*die Gedanken und deren Zusammenhang*),<sup>7</sup> a low degree of distinctness causing attention to be strained by an effort to make up for the lack of thorough clarity of individual notes. Forkel proceeds then to discuss how to acquire this highest degree of distinctness in the touch,<sup>8</sup> not without first criticising Emanuel Bach for having omitted this description in his *Versuch*. Forkel's criticism takes as its departure point what he considers as Emanuel Bach's vague description of the right touch:

Einige Personen spielen klebericht, als wenn sie Leim zwischen den Fingern hätten. Ihr Anschlag ist zu lang, indem sie die Noten über die Zeit liegen lassen. Andere haben es verbessern wollen, und spielen zu kurz; als wenn die Tasten

<sup>4</sup> Forkel, *Bachs Leben*, Ch. III, 11; David, Mendel, and Wolff, *NBR*, 431. I use here the *The New Bach reader (NBR)* as the reference for the English translation of Forkel's work. However, at times I offer a revised version of this text. This situation will be duly indicated.

<sup>5</sup> Joel Speerstra translates this phrase as 'the art of attack'. See Joel Speerstra, *Bach and the Pedal Clavichord: An Organist's Guide* (Rochester, NY: University of Rochester Press, 2004), 77. Emanuel Bach states that the expressions *das Anschlagen der Tasten* and [*der*] *Druck [der Tasten]* are equivalent. See Bach, Ch. 3, Performance, § 17. Nevertheless, in some instances the terms *Anschlagen*, *Anschlagung*, *Anschlag* and *Druck* appear to refer to more subtle aspects of the use of the finger on the key, and to the effect of the handling of the key on the action of the instrument. I have tried to carefully distinguish these aspects by relating the use of the word to the particular context in which it appears each time. See the discussions below.

<sup>6</sup> Forkel, *Bachs Leben*, 13; David, Mendel, and Wolff, *NBR*, 432.

<sup>7</sup> Forkel, *Bachs Leben*, 12; David, Mendel, and Wolff, *NBR*, 431.

<sup>8</sup> See David, Mendel, and Wolff, *NBR*, 431–432. For a compelling review of Forkel's indications, including a revision of the 1820 English translation of Forkel's book, see Speerstra, *Bach and the Pedal Clavichord*, 70–78.

glühend wären. Es thut aber auch schlecht. Die Mittelstrasse ist die beste; ich rede hievon überhaupt; alle Arten des Anschlages sind zu rechten Zeit gut.

There are many who play stickily, as if they had glue between their fingers. Their touch is lethargic; they hold notes too long. Others, in an attempt to correct this, leave the keys too soon, as if they burned. Both are wrong. Midway between these extremes is best. Here again I speak in general, *for every form of the touch is in order at the proper time.*<sup>9</sup>

Emanuel's description is also problematic to the modern reader. Arguably, it does not help to identify the particular movements required to accomplish the highest degree of distinctness in the touch. But, perhaps, to Emanuel Bach the discussion of a set of mechanical movements characterising a 'midway' touch was not central as one might suppose it should be (see discussion below and note 25 below). As I will suggest, Emanuel Bach was probably more preoccupied, given the impossibility of offering instructions which might have been better transmitted through oral, and visual, instruction,<sup>10</sup> to raise a consciousness among his readers that the right touch to be employed at any given situation depended on a variety of factors. These went from paying attention to the proper way in which one must be seated at the keyboard, the positioning of the fingers and the proper relaxation of the muscles,<sup>11</sup> to an awareness of the particular requirements called for by the action of the keyboard instrument<sup>12</sup> and the importance of recognising the performance requirements of the music.<sup>13</sup> It appears then that, for Emanuel Bach, it is through an observance and consideration of all these factors during practice—in particular an attention to the content of the piece—that one would be in the position to acquire the ability to offer a good performance. This ability would be partly manifest in the form of a diversified touch that would allow the performer to bring about the effect of a piece

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<sup>9</sup> Bach, *Versuch*, Ch. 3, Performance, § 6. As stated in chapter 1 (note 1), the English translation is taken from Bach, *Essay*. Throughout this chapter I will use italics to indicate a variation from Mitchell's translation. In some occasions I provide an alternative one, a situation which will be duly indicated.

<sup>10</sup> A problem recognized by both J.S. Bach (e.g. in the case of the instruction of particular problems of thorough-bass) and Forkel. Forkel informs his readers that he 'will endeavour to make the matter plain [the ways and means to attaining this middle path] as far as such things can be made plain without oral instructions'. See Georg von Dädelsen, ed., *Klavierbüchlein Für Anna Magdalena Bach (1725)* (Kassel: Bärenreiter, 1959), 125; for Forkel, *Bachs Leben*, Ch. III, 12; David, Mendel, and Wolff, *NBR*, 432.

<sup>11</sup> Bach, *Versuch*, Ch. 1, Fingering, § 10–12.

<sup>12</sup> Ibid. Introduction, § 11–13 and 15.

<sup>13</sup> Ibid. Ch. 3, Performance, § 4.

of music as defined by its content (see below). Both the variety of touch and an awareness of the effect the music should produce in listeners would also depend in the above referred factors being complemented by the listening and visualization of the master's demonstrations and performances, as well as to that of accomplished musicians, particularly singers. These performances were expected to contribute to the building up of the experience necessary to identify the most adequate touches to be called for at any given musical situation.

Emanuel Bach may well have considered, as his text seems to suggest, that the availability of a variety of touches—to be employed at proper times—rather than only one, would have aided in achieving the ‘distinctness’ in playing mentioned by Forkel. Consequently, the set of mechanical movements Forkel seems to consider as basic for distinctness in playing, and to be used on all keyboard instruments,<sup>14</sup> might have been for Emanuel one among several from which a performer could choose.

The touch described by Forkel in J.S. Bach's biography is briefly recalled by Johann Joachim Quantz. In his *Versucheiner Anweisung, die Flöte Traversière zu spielen* he observes that one can strike one finger more forcefully than another if one has been accustomed

[...] einige Finger einwärts zu beugen, andere aber gerade auszustrecken: welches nicht nur eine ungleiche Stärke im Spielen verursacht; sondern auch hinderlich ist, geschwinde Passagien rund, deutlich und angenehm vorzutragen.

[...] to curve some fingers inwards while extending others straight forward, a habit that not only causes inequality in the force of your playing, but is also obstructive to the round, distinct and agreeable execution of quick passage-work.<sup>15</sup>

The consequence will be that, as in the case of many persons, one will

[...] wenn er einen Lauf von etlichen Noten stufen weis zu machen hat, nicht anders klingt, als wenn er über die Noten wegstolperte.

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<sup>14</sup> On the problem of the word *clavier*, particularly in the English translation of Forkel's book, see Speerstra, *Bach and the Pedal Clavichord*, 76–77.

<sup>15</sup> This and the following citations are from Johann Joachim Quantz, *Versuch Einer Anweisung Die Flöte Traversiere Zu Spielen* (Berlin: Johann Friedrich Voß, 1752), Ch. XVII, part VI, § 18. The English translation is taken from Johann Joachim Quantz, *On Playing the Flute*, trans. and ed. Edward R. Reilly (London: Faber and Faber Limited, 1985), 259–260.

[...] sound as if [one] were literally stumbling over the notes if [one has] to produce a run of several step-wise notes.

But

[...]ewöhnt man sich aber gleich Anfangs, alle Finger, einen so weit als den andern, einwärts zu beugen; so wird man diesen Fehler nicht leicht begehen. Man muß aber bey Ausführung der laufenden Noten, die Finger nicht so gleich wieder aufheben; sondern die Spitzen derselben vielmehr, auf dem vordersten Theile des Tasts hin, nach sich zurücke ziehen, bis sie vom Taste abgleiten. Auf diese Art werden die laufenden Passagien am deutlichsten herausgebracht. Ich berufe mich hierbey auf das Exempel eines der allergrößten Clavierspieler, der es so ausübte, und lehrete.

[...]if you accustom yourself at the very beginning to curving all the fingers inwards, each one as far as the others, you are less likely to make this mistake. In the performance of these running passages, however, you must not raise the fingers immediately after striking the key, but rather draw the tips of the fingers back towards yourself to the foremost part of the key, until they glide away from it. Running passages are produced most distinctly<sup>16</sup> in this manner. I appeal here to the example of one of the greatest of all players on the keyboard, who practiced and taught in this way.<sup>17</sup>

Quantz hence advises his readers to adopt a homogeneous curving of the fingers (*alle Finger [...] einwärts zu beugen*), something which, he tells us, will help to avoid an ‘inequality in the force of playing’ (*ungleiche Stärke im Spielen*) and any hindering for a ‘round, distinct and agreeable execution of quick passage-work’ (*geschwinde Passagien rund, deutlich und angenehm vorzutragen*); otherwise, one would sound as if one would be ‘stumbling over the notes’ (*über die Noten wegstopperter[n]*). For his part, Forkel suggests that by holding the fingers bent no ‘scrambling, thumping, and stumbling’ (*Das Hacken, Poltern und Stolpern*)<sup>18</sup> will occur. Emanuel also advises his readers to play ‘with curved fingers’ (*mit gebogenen Fingern*),<sup>19</sup> later warning them that in the quickest passages (*geschwindesten Gedancken*) an ‘uneven

<sup>16</sup> ‘am deutlichsten’.

<sup>17</sup> Quantz is referring to Johann Sebastian Bach, who is later identified in the *Versuch*, Ch. XVIII, § 83.

<sup>18</sup> Forkel, *Bachs Leben*, Ch. III, 13. In the introduction to the *Versuch* Emanuel Bach uses similar terms. He observes there that players ignorant of the three factors of the true art of keyboard playing (correct fingering, good embellishments and good performance) will lack roundness, distinctness and naturalness (*das runde, deutliche und natürliche*). In place of these, there is *Gehacke, Poltern* and *Stolpern*. See Bach, *Versuch*, Introduction, § 2.

<sup>19</sup> Ibid. Ch. 1, Fingering, § 12.

and indistinct handling of the key' (*ungleich und undeutlich Anschlag*) will be caused when each note is not given its 'proper touch' (*gehörigen Druck*).<sup>20</sup> Although some of these observations would appear to be more or less clear to the modern reader, others seem to require a more detailed analysis that could help to reveal their implications thoroughly.

Let us first mention that all three authors agree in that the bending of the fingers is a basic requirement for proper playing.<sup>21</sup> However, only Quantz and Emanuel Bach specifically mention the playing of 'fast passage-work' (*geschwindesten Gedanken*)<sup>22</sup> as the situation where a specific touch is required (Quantz) or at which the response of 'the action of the instrument' (*Anschlag*)<sup>23</sup> is affected by an unsuitable treatment of the key. Quantz proceeds then to describe in detail the finger motion to be observed during the playing of fast passage-work, and which will assure a distinct performance.

For his part, Emanuel Bach does not discuss the mechanical components of the 'proper touch' to be observed at the situation described by Quantz. It appears that for him a careful attention to the 'true content of the piece' is more crucial to the

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<sup>20</sup> 'Auch in der geschwindesten Gedancken muß man hiebey ieder Noter ihren gehörigen Druck geben; sonst ist der Anschlag ungleich und undeutlich'. Ibid. Ch. 3, Performance, § 4. See the translation below, p. 118–119.

<sup>21</sup> Rameau observes that the long fingers will bend as a result of placing the thumb and the fifth finger on the edge of the key, and the natural tendency of these to curl. See Rameau, "De La Mechanique Des Doigts," 17. The bending of the fingers is already recommended by Girolamo Diruta. See Diruta, *Il Transilvano*, f. 4 v. and 5 r.; MacClintock, *Readings in the History of Music in Performance*, 88–89. The influence of Italian musicians present in French courts, particularly in those of Catherine (1519–1589) and Marie de' Medici (1575–1642), might have helped to spread this practice in France. Diruta's indications about the position of the fingers seem to resonate in texts by Guillaume Gabriel Nivers and, later, Saint Lambert. See Guillaume Gabriel Nivers, *Livre D'orgue Contenant Cent Pièces de Tous Les Tons de L'église* (Paris: R. Ballard, 1665), *De la position des doigts*; Saint Lambert, *Les Principes Du Clavecin*, 42.

<sup>22</sup> In a revised edition of the *Versuch* from the year 1856, Gustav Schilling introduces variants to Emanuel's original text. These two words are given in the revision as *schnellsten Passagen* which is an expression closer to that used by Quantz. Space and time do not permit to make use of all these variants at this place. Nevertheless, they might be worthy of a detailed study.

<sup>23</sup> For the complete passage, see above, note 20. The term *Anschlag*, in this particular situation, appears to refer to the handling of the action and the outcome of its motion. Its movements will be unequal and indistinct (*ungleich und undeutlich*) if the touch required (*gehörigen Druck*) by the musical ideas (*Gedanken*) is not applied to each note. The substantive *Druck* appears then to refer to a distinct force, related also to the musical content of the piece, applied by the performer's finger. If this is not well balanced in all fingers of the hand the *Anschlag*, the response of the action and its effect on the string or organ pallet, becomes irregular. See also the discussion on *Anschlagung des Tangenten* in notes 5 and 65.

acquisition of an appropriate form to handle the instrument than a fixed mechanical preparedness of touch:

Der gute Vortrag ist also sofort daran zu erkennen, wenn man alle Noten [...] zu rechter Zeit in ihrer gehörigen Stärke durch einen nach dem wahren Inhalte des Stücks abgewognen Druck mit einer Leichtigkeit hören läßt.

A good performance is to be immediately recognised when one, with an easiness, lets all the notes [...] to be heard—through a touch that has been pondered after the true content of the piece—at the right time and in their proper volume.<sup>24</sup>

This ‘well-pondered touch’ (*abgewognen Druck*) should proceed from a deep consideration of the particular requirements of any given musical circumstance. Fast passage-work appears not to be an exception since for Emanuel every note has to gain its ‘proper touch’. He thus leaves the performer, as will become clear through the discussion of some other paragraphs of the *Versuch*, to procure through experience the fine motor ability for a handling of the instrument’s action which would help to produce a sought-after effect.

Given Emanuel’s lack of words concerning the physical movements to be employed at the keyboard<sup>25</sup>—nevertheless making emphatic observations about the necessary preconditions for these movements—one could only speculate that he might have agreed with Quantz’s recommendation for the physical handling of the key in relation to the performance of fast passage-work. After all, it appears to have been in accordance with the practices of Emanuel’s father. There is, however, an issue which one must recall and emphasise concerning Quantz’s suggested set of finger movements: it appears to be reserved for the performance of fast notes. If one

<sup>24</sup> Bach, *Versuch*, Ch. 3, Performance, § 4. My translation.

<sup>25</sup> See above, pp. 111–112. The reasons behind Emanuel’s silence regarding the particulars of the technique to be employed in fast passages might have to do with those related to his vague description of touch. Quentin Faulkner has suggested that Emanuel Bach did not transmit his father’s instructions in this matter because he ‘did not consider it of sufficient import or relevance to include in the *Versuch*’. Although Faulkner suggests that Emanuel might have omitted the transmission in detail of his father’s touch as a result of ‘his almost exclusive cultivation of the clavichord and his neglect of the organ’, one has to remember that Emanuel Bach’s instructions in the *Versuch* were aimed at discussing touch on the clavichord, the harpsichord, and the fortepiano. Faulkner also names as the possible reasons for this omission the difficulty of the technique, something which might have prompted Emanuel Bach to avoid discussing it for practical reasons, and the possibility that the technique was ‘a sort of “trade secret”’. See Quentin Faulkner, *J.S. Bach’s Keyboard Technique: An Historical Introduction* (St. Louis MO: Concordia, 1984) 19–20; and Speerstra, *Bach and the Pedal Clavichord*, 75.



looks closely at the phrasing of the paragraph where he explains the type of finger action required for this playing situation (i.e. the forced withdrawing of the finger tip), one will find that this finger action is to be used instead of that in which the finger is lifted right away (*gleich wieder aufheben*). This suggests that in the performance of slow, and probably also moderate fast, passages the finger could have left the key in this or other ways. Hence, fast passage-work appears to be a particular case where a forced withdrawing is required in order to attain a degree of distinctness probably not present when the key is released using any other type of finger movement. This opens the possibility that for J.S. Bach, and probably also for his sons, the lifting of the fingers was indeed the standard movement during the release of the key. Since Quantz seeks to strengthen his remarks by appealing to the example of J.S. Bach's practice and teaching, one is tempted to suggest that he might had also witnessed this lifting of the fingers during Bach's performances.

The use of the verb 'to lift' (*aufheben*) immediately suggests that the finger travels upwards during the key's release. However, within this release movement a gliding one might also have been present to some degree.<sup>26</sup> This could have happened in two forms:

1. if the finger was to be actively lifted by the player its natural tendency to draw in the direction of the palm of the hand was to produce, as a result of the finger's relaxation, a certain amount of movement of the tip in the same direction; or
2. if in order to release the key the finger was relaxed this last was to be pushed upwards by the key.<sup>27</sup> The relaxation would have also driven the finger to move, to a certain extent, in the direction of the palm.

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<sup>26</sup> While the verb *aufheben* seems to indicate that the finger is to be lifted this situation would not preclude the simultaneous presence of a gliding movement of the finger in the direction of the palm of the hand. In his *Versuch*, Bach uses the term in the sense of 'release' (e.g. Bach, *Versuch*, Ch. 2, Embellishments, I, § 20; and Ch. 3, Performance, § 21 and 30). Quantz's uses the term at least once in the sense of 'to raise' (e.g. '*den Finger gar nicht hoch aufhebe*' (do not raise the finger high); Quantz, *Versuch*, Ch. IX, § 9, my translation). On the other hand, Forkel uses the term *heben*. However, he is particularly clear that the movement that should be avoided is a perpendicular rising from the key: '*nicht gerade aufwärts*'. See Forkel, *Bachs Leben*, Ch. III, 12; David, Mendel, and Wolff, *NBR*, 432.

<sup>27</sup> For the organological reason for this, see chapter 2, note 137.

As can be seen, in both circumstances the finger might have glided away from the initial striking point. However, in contrast with the finger action described by Quantz, this type of withdrawing in the direction of the palm of the hand is of an unforced nature. In other words, the movement results from the relaxation of the finger and the disappearance of obstacles preventing the finger's natural retraction. These considerations suggest that finger gliding was, probably more often than not, present during playing, particularly when the 'fingers [were] curved and the tendons and muscles relaxed'.<sup>28</sup> But its manifestation in a less apparent form, namely, when it was graded downwards in order to achieve the distinctive touch qualities necessary in particular instances—such as when playing slow-paced, non-legato lines—would have precluded its clear observation and documentation by Quantz.

Forkel's description of the physical and mechanical aspects of touch appears not to leave space for the adoption of another kind of finger movement during the release of the key (such as the perpendicular raising of the finger from the key). Furthermore, his description of the movement not only suggests that the finger is to be forced to withdraw at all times. It also hints at a rejection of the withdrawing movement resulting from relaxation. This would be in disagreement with the above proposed reading of Quantz's description of J.S. Bach's technique. Before this possible discrepancy may be fully addressed it will be necessary to discuss some remarks in the *Versuch* which might help us to shed some more light upon Emanuel Bach's views on touch.

Forkel's description of touch takes Emanuel's above-quoted recommendations on the same issue as its point of departure. However, he appears not to find it necessary to recount the information related to it which Emanuel Bach offers in other passages of the *Versuch*. One of these omissions is precisely the paragraph in which Emanuel talks about the performance of fast passages (*geschwindesten Gedancken*), where he observes that

(1) Auch in der geschwindesten Gedancken muß man hiebey ieder Noter ihren gehörigen Druck geben; sonst ist der Anschlag ungleich und undeutlich.

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<sup>28</sup> Bach, *Versuch*, Ch. 1, Fingering, § 12.

(1) Also in fast passages one must give every note its proper touch; otherwise the attack of the key [will be] uneven and indistinct.<sup>29</sup>

In the same paragraph, as we have seen above, Emanuel Bach observes that

(2) Der gute Vortrag ist also sofort daran zu erkennen, wenn man alle Noten [...] zu rechter Zeit in ihrer gehörigen Stärke durch einen nach dem wahren Inhalte des Stücks abgewogenen Druck mit einer Leichtigkeit hören läßt.

(2) A good performance is to be immediately recognised when one, with easiness, lets all the notes [...] to be heard—through a touch that has been pondered after the true content of the piece—at the right time and in their proper volume.

And continues observing that

(3) Hieraus entstehet das Runde, Reine, und Fliessende in der Spielart, und wird man dadurch deutlich und ausdrückend.

(3) From all these emerges the roundness, purity, and fluency in the form of playing through which one becomes clear and expressive [in performance].<sup>30</sup>

Thus, for Emanuel Bach the effective communication of the true content of a piece will partly be due to the player's distinctness and expressivity in performance, a consequence of the proper duration and loudness of the notes. As suggested above, these two last elements at the centre of Emanuel Bach's reflections on performance do not appear to be for him the outcome of physical readiness—although this last is certainly an issue which he considers of utmost importance<sup>31</sup>—but rather the result of the performer's understanding of the music. Emanuel Bach then does not confine clarity and expression during the act of performance to bodily considerations restricted to the movements of the hand and the fingers. This becomes more evident when one observes that for him, a way to gain an understanding of the true content and affect of a piece is through listening to 'soloists and ensembles':<sup>32</sup> a recurrent contact with the performance of able musicians will help to nuance the aspiring

<sup>29</sup> Ibid. Ch. 3, Performance, § 4. My translation. Mitchell translates *Druck* as pressure, *Anschlag* as effect, *ungleich* as turgid, and *undeutlich* as chaotic. See Bach, *Essay*, 147.

<sup>30</sup> Bach, *Versuch*, Ch. 3, Performance, § 4. My translation.

<sup>31</sup> Ibid. Ch. 3, Performance, § 1. Emanuel Bach criticises the tendency to mechanical playing of both very capable and poorly skilled players. However, he hints at the possibility that those with good disposition of mind and ready to subject themselves to some reasonable rules would be in the position to perform a piece in such a form that it will move their listeners.

<sup>32</sup> Ibid. Ch. 3, Performance, § 8.

musician's ability to identify the fittest manner to perform the notes. This attention and reliance in the practice of others—which includes eavesdropping, something which Emanuel Bach qualifies as a permitted form of theft<sup>33</sup>—is necessary since the presentation of the true content and affect of a piece, through the shaped notes and agreeable ornaments, depends on various 'incidental things'.<sup>34</sup> Praxis is thus at the core of an understanding of the nuances of performance.<sup>35</sup>

In his discussion regarding the importance of the player's awareness of the content of the music Emanuel Bach also provides substantial information with respect to the elements underlying the nature of touch. This notwithstanding, he is not specific about the precise mechanical movements to be used at any given circumstance.<sup>36</sup> As has been observed, Quantz recommended the use of a distinctive mechanical component of touch at a particular instance: quick passage-work. But his observation that the use of a gliding-off finger movement will allow a distinct production of running passages has perhaps to be regarded as an exceptional recommendation to be solely followed during these particular playing instances. Forkel, on the other hand, tells us that the use of this very movement, together with the consequential rapid transference of energy from one finger to the next, would produce the highest degree of distinctness in the handling (*Anschlage*) of individual notes. As a consequence, every passage performed in this form will

[...] glänzend, rollend und rund klingt, gleichsam als wenn jeder Ton eine Perle wäre.

[...] sounds brilliant, rolling, and round, as if each [note] were a pearl.<sup>37</sup>

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<sup>33</sup> Ibid. Prologue, 3 v.

<sup>34</sup> Ibid. Ch. 3, Performance, § 8.

<sup>35</sup> Forkel observes that in order to facilitate the study of a piece J.S. Bach used to play it for the pupil beforehand. This was to help him or her to gain an idea of the 'true character' (*wahren Charakter*) of the music. It is thus from an impression of the aimed perfection (*Vollkommenheit*), and an understanding of the piece, that the fingers will better 'obey': '*Ueberdieß ist nun der Verstand mit in das Spiel gezogen worden, unter dessen Leitung die Finger weit besser gehorchen, als sie ohne dieselbe vermögen würden*'. See Forkel, *Bachs Leben*, Ch. VII, 39; David, Mendel, and Wolff, *NBR*, 453–454.

<sup>36</sup> One important exception is the *Schnellen*. See Bach, *Versuch*, Ch. 1, § 90. See also the discussion below on the *Schnellen*, pp. 121 ff.

<sup>37</sup> The passage where this and the following quote appear reads: '*Das Einziehen der Fingerspitzen nach sich, und das dadurch bewirkte geschwinde Übertragen der Kraft des einen Fingers auf den zunächst darauf folgenden, bringt den höchsten Grad von Deutlichkeit im Anschlage der einzelnen Töner*

As pointed out above, Forkel does not restrict the gliding-off movement to any particular situation as Quantz does.<sup>38</sup> He, thus, seems to imply that it is to be considered as the basis for the ordinary touch. Since in his opinion this movement allows the highest degree of distinctness in performance, and this aspect of playing is for him at the centre of a perfect performance, one should then probably contemplate its use at almost every passage. This point of view appears to be strengthened when one considers his description of J.S. Bach's indications regarding the positioning of the hand, where Forkel does not seem to give any alternative to the gliding-off movement of the finger. He later argues that it is precisely this movement which is responsible for

[...] den höchsten Grad von Deutlichkeit im Anschlage der eynelnen Töner hervor  
[...]

[...] the highest degree of distinctness in the handling of individual notes [...]<sup>39</sup>

The paragraph including the indications about the physical use of the hand concludes with the assertion that if one is to handle the keys through the proposed physical approach the touch (*Anschlag*) will be

[...] wie C.Ph. Emanuel sagt, weder zu lang noch zu kurz, sondern genau so wie er seyn muß.

[...] as C.Ph. Emanuel says, neither too long nor too short, but precisely as it must be.<sup>40</sup>

## Emanuel Bach's *Schnellen*

In his discussion on tone production on the harpsichord,<sup>41</sup> Quantz affirms that the performer's individual characteristics of tone reside in his or her particular touch

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*hervor, so daß jede auf diese Art vorgetragene Passage glänzend, rollend und rund klingt, gleichsam als wenn jeder Ton eine Perle wäre. Es kostet dem Zuhörer nicht die mindeste Aufmerksamkeit, eine so vorgetragene Passage zu verstehen*. Forkel, *Bachs Leben*, Ch. III, 13; David, Mendel, and Wolff, *NBR*, 432.

<sup>38</sup> For a discussion on the use of the *Schneller* in Quantz, see below. Menno van Delft has already observed that Forkel seems to suggest that the movement was also to be used during the playing of slow or cantabile passages. See Menno van Delft, "Schnellen: a Quintessential Articulation Technique in Eighteenth-century Keyboard Playing," in *The Keyboard in Baroque Europe*, ed. Christopher Hogwood (Cambridge: Cambridge University Press, 2003), 196.

<sup>39</sup> My translation. See above, note 37 for the complete passage in German.

<sup>40</sup> Forkel, *Bachs Leben*, Ch. III, 13. My translation.

(*de[r] Anschlag*). Quantz proceeds then to identify four aspects which, in his view, are central to the correct production of sound through the handling of the key:

1. Each finger should strike the key with equal force and emphasis, and with the proper weight.
2. The strings should be given sufficient time to vibrate unhindered.
3. In order to keep the strings vibrating for a longer time, which will result in a longer lasting note, a certain energy (*gewisse Kraft*) should be given to the key through the use of a snap (*Schneller*). This is particularly necessary when, in certain cases, the finger depresses the key with excessive restraint.
4. In order to avoid the situation in which some fingers play with more strength than others, all the fingers should be curved inwards. Failure to do so will translate not only in an inequality of loudness in playing, but will also prevent the performance of quick passage-work in a round, distinct and agreeable manner.

Points 1) and 2) mirror Emanuel Bach's description of the elements of touch (see above, pp. 118–119). On the other hand, the precise scope for the application of the recommendations of point 3), probably one of the most informative, is not easy to identify. Both points 2) and 3) are related to the duration of the note.<sup>42</sup> But it is in point 3) where Quantz makes it clear that it is through the use of the *Schneller* that players on the harpsichord will keep the note sounding for a longer time.

Die Ursache davon [der Ton von dem einem [Spieler] besser als von dem andern heraus gebracht wird] muß folglich auf den Anschlag [...] ankommen: [...3)]; oder ob man die Finger mit allzugroßer Gelassenheit niederdrückt, und ihnen nicht, durch einen Schneller, eine gewisse Kraft giebt, daß die Seyten, um den

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<sup>41</sup> Quantz, *Versuch*, Ch. XVII, section VI, § 18.

<sup>42</sup> Quantz's points 2) and 3) are taken up by Forkel. He suggests that the string will vibrate for a longer time when a gliding-off movement of the fingertip is used in combination with a certain amount of pressure. The tone will then be not only more beautiful, but it will also last longer. In this form, he continues, the performer will be in the position to play in a singing manner and to connect the notes. Forkel, in contrast to Quantz (whose recommendations appear to be solely directed to the performance on the harpsichord), also suggests that this mechanism will deliver the same effect in an instrument with such a poor tone as the clavichord. See Forkel, *Bachs Leben*. Ch. III, 13, point 3 (II); and David, Mendel, and Wolff, *NBR*, 432–433.

Ton länger auszuhalten, in eine länger anhaltende Zitterung versetzt werden können; um den Fehler, so dieses Instrument von Natur hat, daß sich die Töne nicht, wie auf andern Instrumenten, an einander verbinden, so viel als möglich ist zu vermeiden.

The reason for [the tone of one person to be better than the one produced by another] must be the touch [... 3); *or the fact*] that one lowers the fingers with excessive restraint, and that these are also not given, through a snap (*Schneller*), a certain force that will make the vibrations of the strings longer in duration, and sustain the tone [note] longer. In this fashion you will obviate as much as possible the natural weakness of the instrument, which is that the tones cannot be joined to one another as upon other instruments.<sup>43</sup>

Legato playing seems to be at the centre of Quantz preoccupations in this section of the paragraph. However, Quantz's presentation of the above-mentioned points might also have been aimed at identifying, for the benefit of his readers, those components of a touch capable of producing the best tone on the harpsichord. It is within this context that his statement on the use of the *Schneller* appears ambiguous as to the realm of its application. Yet, the use of the *Schneller* could be clarified through a more nuanced reading of the whole passage in question.

When point 3) (introduced by the words *oder ob*) is connected to the initial observation on the reason behind the characteristics of the performer's tone (introduced by the words *Die Ursache davon*), it becomes clear that Quantz is suggesting that 'the better tone of some performers' has also its origin in the use of the *Schneller*. The reason for this is that, according to Quantz, the *Schneller* would provide the fingers with 'a certain force that will make the vibrations of the strings longer in duration, and sustain the tone longer'. In the end, though this rearrangement of the text contributes to a better understanding of Quantz's views, it does not entirely clarify if the *Schneller* is to be used as a basic component of the common touch, or it will be solely required at specific instances which the performer would need to recognise.

When the phrasing of the whole section is taken into account, one will find that Quantz seems to be implying that there are musical circumstances where the key has

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<sup>43</sup> Quantz, *Versuch*, Ch. XVII, section VI, § 18; Quantz, *On Playing the Flute*, 259. The words in italics indicate my revision of the translation.

indeed to be pressed down with some ‘restraint’ (*Gelassenheit*): the term *Gelassenheit* is accompanied by the adjective ‘excessive’ (*allzugroßer*);<sup>44</sup> the use of these words together suggests that there are instances where the use of a quiet-moving touch would produce a satisfactory tone. The construction of the paragraph also appears to imply that this is the most common touch in performance, but, at the same time, that the tone production qualities it is able to generate are not congenial with the performance requirements of fast notes. The able performer should then be capable of recognising those specific passages and playing conditions where he will need to adapt, or altogether substitute, this ‘moderated’ touch (e.g. by making use of other resources such as the *Schneller*). Viewed from this perspective, the *Schneller* in Quantz appears exclusively as a requirement through which the performer on the harpsichord will attain a longer duration of the note and a ‘round, distinct and agreeable execution of quick passage-work’. A more general application of it in performance seems then improbable.<sup>45</sup>

Carl Philip Emanuel Bach explains the mechanics of the *Schnellen* in his discussion on how to play repeated notes.<sup>46</sup> Here he observes that in a moderate tempo these notes are to be played with the same finger. However, two alternating fingers and the *Schnellen* should be used in faster tempos. The *Schnellen* is the term which designates a specific finger movement, namely the swift gliding of the finger from the key with the purpose of allowing a distinctive hearing of the beginning of the following note. Although the *Schnellen* is required by Emanuel Bach for the

<sup>44</sup> Reilly translates the term as ‘too sluggishly’. See *ibid.* 259.

<sup>45</sup> The considerations formulated above call for a reappraisal of the views of Friedrich Konrad Griepenkerl (1782–1849) regarding J.S. Bach’s touch—expressed in his 1819 edition of Bach’s chromatic fantasia and fugue—since his ideas closely follow those expressed by Forkel, who was his teacher. One has also to consider that Forkel’s ideas on clavichord playing might partly arise from the approach to the keyboard Emanuel Bach employed during his late years, a time in which Emanuel’s attention to the clavichord exceeded by far that to the organ. Moreover, significant organological modifications experienced by the clavichord, as well as changes in Emanuel Bach’s compositional style (which were perhaps both a consequence of, and a result of, the composer’s continuous exploration of the instrument, particularly during the 1740’s) might have called for different playing resources than those advocated by his father. See below, note 56.

<sup>46</sup> Bach, *Versuch*, Ch. 1, Fingering, § 90. He offers the same explanation in Ch. 2, Ornamentation, III, § 8. It is important to emphasise that while Emanuel Bach uses the term *Schnellen* to refer to the fast withdrawing of the finger from the key in the direction of the palm of the hand, Quantz uses *Schneller* to indicate the use of force. The term *Schnellen* does not appear in Quantz’s *Versuch*. Emanuel Bach also uses the term *Schneller* to refer to an ornament, namely, the snap. From this point onwards I use the term *Schnellen* to refer to the finger action above described. See the rest of the paragraph, and note 47 below. For an etymological analysis of the term *Schnellen*, see Delft, “Schnellen,” 187, note 2.



purposes of highlighting specific notes (most notably in the *Trill* and the *Doppelschlag*),<sup>47</sup> this function is nevertheless not always assigned to this technique.<sup>48</sup> The *Schnellen* appears then as a valuable technical resource capable of shaping sound, its importance being emphasised by its presence in Emanuel Bach's list of the components of performance whose absence or inappropriate timing will be at the centre of a poor performance.<sup>49</sup>

In all, the *Schnellen* seems to have been considered by Emanuel Bach as one serviceable mechanical component of finger action which would only come into use during the performance of clearly defined musical instances. The evidence given above appears then to suggest that Emanuel Bach would not have employed it as a component of the common touch. Furthermore, if the information offered by Quantz is anything to go by, it appears that J.S. Bach was also using the *Schnellen*. However, when one studies the information given in Quantz's report one can perhaps only suggest that Bach used it during the performance of fast passage work. The lifting of the finger after the key had been lowered could then have been the prevailing key's release movement in J.S. Bach's performance of slow and moderate tempo passages. However, as has been observed above, while the forced withdrawing of the finger in the direction of the palm might have been absent during this lifting, yet, a small amount of finger withdrawing may have been present as a result of the relaxation of the finger during the release of the key. In this respect, one probably needs to reconsider Forkel's observation that the movement of the finger which should be avoided during the key's release is a perpendicular rising from the key (*nicht gerade aufwärts*)'.<sup>50</sup> In all, it is then possible that, forced or not, a glide-off movement of the

<sup>47</sup> Bach, *Versuch*. Ch. 2, Ornamentation, III, § 8 and § 32; idem IV, § 26, § 27, and § 30. For an overview of the situations calling for the use of the *Schnellen* and some technical issues connected to its use, see Delft, "Schnellen," 188–192.

<sup>48</sup> For example, see Bach, *Versuch*. Ch. 3, Performance, § 24.

<sup>49</sup> Ibid. Ch. 3, Performance, § 3.

<sup>50</sup> Friedrich Wilhelm Marpurg uses the term *aufhebt* in his description of the common touch (*ordentliche Fortgehen*, i.e. the middle way between *détaché* (*Absstossen*) and *legato* (*Schleiffen*)). However, he does not clarify if while lifting the finger a gliding-away movement is also to be present. Daniel Gottlob Türk indicates that the finger has to be raised (*hebt*) a bit earlier when playing the notes in the common way (*gewöhnliche Art*, i.e. neither detached (*gestoßen*) nor legato (*geschleift*)). No indications as to the characteristics of the movement are given. See Marpurg, *Anleitung Zum Clavierspielen*, 29; Daniel Gottlob Türk, *Klavierschule Oder Anweisung Zum Klavierspielen Für Lehrer Und Lernende*, ed. Siegbert Rampe, Facsimile (Kassel: Bärenreiter, 1997), Ch. 6, III, § 40. See also above, note 26. For an examination of issues related to the notion of common touch, see Paul

finger during the release of the key might have been present at all times in the playing of a number of performers. This idea will become clearer through an examination of the evidence of wear on the surface of the keyboard of historical keyboard instruments.<sup>51</sup>

### **Some considerations regarding touch in the practice of Carl Philip Emanuel Bach**

At the end of the *Versuch*'s paragraph on the performance of repeated notes Emanuel Bach observes that it is on the clavichord that this type of passages are most easily performed. This record of his perception is particularly valuable since it can help both to nuance and enlarge our understanding of the significance of the clavichord in Emanuel Bach's thoughts on performance. It can also serve as a departure point for a review of some of his recommendations on the touch requirements of the clavichord, the harpsichord and the fortepiano.

When Emanuel Bach remarks that it is on the clavichord that this particular kind of passage can be performed in a more easily manner, he is tacitly highlighting the clavichord's musical qualitative standing among contemporary keyboard instruments.<sup>52</sup> If we consider this idea next to his emphasis on the importance of paying attention to the 'true content of the piece', his remark, which on the surface points only to a technical aspect of playing, seems then to be inherently connected to the particularly favourable conditions the clavichord offers him for obtaining a particular musical outcome. This notion needs necessarily to be understood within the context of the clavichord's distinct place and presence in the area of music performance throughout Emanuel Bach's lifetime, and particularly from around the second half of the eighteenth century, a time when its cultural influence grew considerably (i.e. the use of the instrument was not anymore limited to the area of pedagogy, the performance of music by a limited number of amateurs, or the

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Simmonds, "Abstossen, Schleifen and Das Allgemeine Fortgehen—thoughts on Clavichord Touch," in *De Clavicordio III: Proceedings of the International Clavichord Symposium, Magnano, 24-28 September 1997*, ed. Bernard Brauchli, Susan Brauchli, and Alberto Galazzo (Magnano: Musica Antica a Magnano, 1998), 53–60.

<sup>51</sup> See chapter 5, pp. 200 ff., especially pp. 241 ff.

<sup>52</sup> In an earlier paragraph of the *Versuch* Emanuel Bach praises the instrument's qualities and points out some of its advantages (and disadvantages) over the harpsichord and the fortepiano. See Bach, *Versuch*, Introduction, § 11 and § 15.

organist's practice room).<sup>53</sup> Emanuel Bach's words appear thus as a testimony to the instrument's broader presence in music-making circles—including some social strata where the harpsichord had only had a limited influence during the previous decades—and to its growing influence as a vehicle for the appreciation of music performance.

Emanuel Bach's observation directs the attention towards the impact on performance of the individual characteristics of each instrument's touch. One example of this is found in his remarks on the use of the *Schnellen*. In his opinion, the *Schnellen* is necessary for the performance of trills. Its execution, however, becomes problematic on the fortepiano. According to Emanuel Bach, this is due to the fact that the *Schnellen* requires the finger to apply 'a certain amount of force' (*einen gewissen Grad der Gewalt*) to the key;<sup>54</sup> the finger action resulting from this requirement will almost inevitably produce an undesired loudness increase when the snapped note (i.e. the penultimate note) of the trill is performed.<sup>55</sup> The discussion of

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<sup>53</sup> Emanuel Bach stresses that it is on the clavichord that good performance is to be learnt (ibid. Introduction, § 15), while highlighting that those performing solely on other instruments would benefit from playing on it. However, he also seems to have intended to emphasise an idea that the clavichord's resources as a performance instrument were akin to those of the harpsichord and the fortepiano.

<sup>54</sup> Ibid. Ch. 2, Ornamentation, III, § 36. This expression is probably concerned with the energy that needs to be applied to the key in order that the tangent, or the jack in the harpsichord, reaches the necessary speed to attain the desired sound effect. Although the amount of speed has a limited effect on the clavichord's sound, it considerably affects loudness on the fortepiano as a result of the particular action of this instrument. See below, note 55. Emanuel Bach uses the term *Geschwindigkeit* (speed, pace, velocity). However, this term may refer either to the speed of the movement from one note to another, or to the tempo of a passage or a composition. It is thus never used in connection with the mechanical action of the finger. See, for example, ibid. Ch.1, Fingering, § 90 (which refers to the tempo of the piece), or Ch. 2, Ornamentation, III, § 14 (speed of notes). Mitchell's translation is sometimes problematic in relation to the use of this term. See, for example, the chapter on Performance, § 1, where the term *Geschwindigkeit* is translated as 'technique', 'dexterity', 'finger velocity', and 'speed'.

<sup>55</sup> In 1785 Ernst Wilhelm Wolff observed that '[i]n today's style of brilliant playing, the détaché is very common: in allegro runs are all played detached, if not expressly forbidden by the slur, as often happens. With dotted rhythms, the détaché can be used both in adagio and allegro [...]'. See Christopher Hogwood, "A Supplement to C. P. E. Bach's Versuch: E. W. Wolf's Anleitung of 1785," in *C.P.E. Bach Studies*, ed. Stephen L Clark (Oxford: Clarendon Press, 1988), 145–146. Wolf's statement must be interpreted within the realm of clavichord playing, whereas much of Emanuel Bach's *Versuch*, and particularly his instructions on the *Schnellen*, apply to all keyboard instruments. The mechanical reason behind the problem is that on the clavichord the impact of the *Schnellen* is less exacerbated due to its action's limited capability to transmit energy to the string; in the fortepiano's case, the same force applied by the same finger (supposing that the weight of the key is the same) will transmit more energy to the string as the hammer will necessarily suffer an acceleration as a result of the instrument's action leverage. Thus, the volume will be much larger than on the clavichord. See Thomas Rossing, *The Science of String Instruments* (New York: Springer, 2010), 139 and 356.

this issue denotes Bach's degree of acquaintance with the specific touch qualities of all three stringed keyboard instruments and which was probably indebted to the professional experience gained in Berlin during the decade preceding the publication of the *Versuch*.<sup>56</sup>

### A note on the touch on the fortepiano

In the introduction to his *Versuch* Bach urges his readers to study the touch of the fortepiano with particular attention; in his opinion, it entails significant problems for the performer.<sup>57</sup> As pointed out above, the use of the *Schnellen* might have been one of the particular problems Bach had in mind. There are, however, other aspects of the fortepiano's touch, derived from the particular action of the instrument, which Bach also took into account when expressing this opinion.

When writing about the touch of the fortepiano Emanuel Bach might have been thinking about the pianos of Gottfried Silbermann (1683–1753), instruments with which he might already have been familiar for some time. These instruments have an action similar to that found in those of Bartolomeo Cristofori (1655–1732), especially in Cristofori's 1726 instrument.<sup>58</sup> One characteristic of the action of this instrument is that the hammer is fixed to a rail. When the key is pressed down, the escapement tongue, placed in the key lever, helps an intermediate lever to push the hammer upwards. At certain point during the rotational movement of the key the tongue disengages from a wedge-shaped block glued to the lower part of the intermediate lever, something which allows this last to fall back to its rest position. It is at this point that the key lever is suddenly freed from the weight of both the intermediate lever and the ascending hammer, something which, despite their

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<sup>56</sup> See David Schulenberg, "When Did the Clavichord Become C.P.E. Bach's Favorite Instrument? An Inquiry into Expression, Style and Medium in Eighteenth-Century Keyboard Music," in *De Clavicordio IV: Proceedings of the IV International Clavichord Symposium, Magnano, 8-11 September 1999*, ed. Bernard Brauchli, Susan Brauchli, and Alberto Galazzo (Magnano: Musica Antica a Magnano, 2000), 37–53. Emanuel Bach might have had plenty of opportunities to study and perform on the harpsichord and the fortepiano at Frederick's II court. How this experience influenced his music for clavichord is at the centre of Schulenberg's essay.

<sup>57</sup> Bach, *Versuch*, Introduction, § 11. Emanuel Bach uses the term *Tractirung* to refer to the touch of the instrument. The term also appears in the introduction, § 13.

<sup>58</sup> At the Grassi Museum für Musikinstrumente der Universität Leipzig, cat. no. 170. For a detailed description of the actions of Cristofori and Silbermann's pianos, see Stewart Pollens, *The Early Pianoforte* (Cambridge: Cambridge University Press, 1995), 56–73, 175–178, especially 65–70.

lightness, might produce a slightly different touch sensation at the lower level of the key. Shortly afterwards this situation has taken place, the hammer, after having stuck the string, will fall back, only to be caught by the backcheck mounted on the back of the key lever. This situation will again produce a small weight change in the key—the intermediate lever will not exercise any force on the key lever at this point—as a result of the downwards force produced by the hammer’s accelerated mass. While perhaps small in its amount, the weight change might again produce a significant effect on the touch felt by the performer. It is significant that one of the few differences between Gottfried Silbermann’s fortepiano actions and at least one by his nephew Johann Heinrich Silbermann (1727–1799) is precisely the absence of the backchecks.<sup>59</sup> In J.H. Silbermann’s instrument the function of catching the falling hammer is assigned instead to a wood rail which is placed above the back end of the keys, but which in no manner has an effect on their action. The reasons behind this modification might have to do with the touch disturbances above described. These, probably, were also behind Emanuel Bach’s recommendation to carefully study this instrument’s touch.<sup>60</sup>

### **Touch on the clavichord and the harpsichord**

It is also in the *Versuch*’s introduction that Emanuel Bach emphasises that a thorough understanding and mastery of the touch of both the clavichord and the harpsichord—as defined by their individual mechanical actions—is fundamental as it would benefit the performance’s effect when playing on any of these two instruments.<sup>61</sup> Bach’s discussion signals first, that it is through both the knowledge of the characteristics of the instrument’s touch and the acquisition of the fine motor ability necessary to manipulate each instrument’s key that the musician would be in the position to put

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<sup>59</sup> This instrument (Strasburg, 1776) is in the collection of the Musikinstrumenten-Museum, Berlin, cat. no. 12. On the differences between the fortepiano actions of G. Silbermann and J.H. Silbermann, see Conny Restle, “Gottfried Silbermann Und Die Hammerflügel Für Den Preussischen Hof in Potsdam,” *Jahrbuch Des Staatlichen Instituts Für Musikforschung Preußischer Kulturbesitz* (2001): 202. A diagram of the action of J.H. Silbermann’s 1776 piano can be found in Gesine Hasse and Dieter Krieckeberg, *Tasteninstrumente Des Museums: Kielklaviere, Clavichorde, Hammerklaviere* (Berlin: Staatliches Institut für Musikforschung, 1981), 77.

<sup>60</sup> The situations above described are not present in the actions of the clavichord and the harpsichord, though on the clavichord the kink can have an appreciable effect on the finger’s stability. See below, pp. 135 ff. For an explanation of the term ‘kink’, see below, note 81.

<sup>61</sup> Bach, *Versuch*, Introduction, § 15.

skilfully into practice those elements belonging to the realm of performance.<sup>62</sup> He emphasises that an absence or the incorrect timing of these elements (due to a lack of mechanical skill or an awareness of the content of the piece) would be detrimental to the presentation of the musical content of a work. Second, that an awareness of the effect of the clavichord's resources in performance—through the mastery of its touch nuances—will help the keyboardist to convey a comparable effect when performing on the harpsichord.

Performances of the same piece of music on instruments with different actions will call for the use of the same elements of performance discussed by Emanuel Bach.<sup>63</sup> This could become then the source of intricate mechanical and musical problems for the keyboardist—just as the use of the *Schnellen* on the fortepiano demonstrates.<sup>64</sup> Furthermore, the performance outcome of those used to play exclusively on instruments with the same type of action could experience some limitations: as Bach observes, those who perform on the harpsichord without playing the clavichord on a regular basis will perform in a single colour. This is a result of the player's lack of attack variety, something which does not occur in good clavichordists. An unfavourable effect, however, can be also encountered when one plays exclusively on the clavichord, namely that the clavichordist will be unable to bring out fine details on the harpsichord since he will not be capable of delivering 'the adequate touch' (*hinlänglichen Druck*)<sup>65</sup> required by the instrument's action. Here, a brief parenthesis is necessary to discuss this idea.

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<sup>62</sup> 'Die Gegenstände des Vortrages sind die Stärke und Schwäche der Töne, ihr Druck, Schnellen, Ziehen, Stossen, Beben, Brechen, Halten, Schleppen und Fortgehen' (The subject matter of performance is the loudness and softness of tones, touch, the snap, legato and staccato execution, the vibrato, arpeggiation, the holding of tones, the retard and accelerando). Ibid. Ch. 3, Performance, § 3.

<sup>63</sup> One exception is the *Bebung* which can only be physically performed on the clavichord.

<sup>64</sup> Other problems might arise as a result of the particular setting of an instrument. For this reason, Emanuel Bach urges his readers to test in advance the instrument in which they intend to play in order to adapt their fingers to the specific characteristics of its touch. The necessity of adopting this approach becomes clear when one takes into account some of the demands that the handling of the weight of the key entails: the use of a lighter or heavier touch than that required by the instrument's key could greatly affect the resulting qualities of the string's sound. See *ibid.* Ch. 3 Performance, § 4. See also the discussion below on the finger-knuckle relation, pp. 135 ff.

<sup>65</sup> Ibid. Introduction, § 15. My translation. For another alternative to Mitchell's translation, see Speerstra, *Bach and the Pedal Clavichord*, 83. Bach's expression *Anschlagung des Tangenten* probably considers the conjunct system composed by the jack and the quill (i.e. those specific components of the harpsichord's action). The jack serves as an extension that helps to position the

According to Emanuel Bach, playing exclusively on the clavichord may result in a loss of finger strength (*Stärke*), a situation which appears to be related to the clavichordist's habit-forming to stroke (*schmeichlen*) the keys.<sup>66</sup> In Bach's opinion this will result in a loss of the ability of the fingers to exert force, especially in the form required by the harpsichord's touch.<sup>67</sup> Bach might be referring to the loss of a qualitative, rather than a quantitative, finger capability to transfer force to the key as a result of a lack of a specific motor finesse required on the harpsichord that is not developed in clavichord playing. I will argue below (see below, pp. 135 ff.) that the inability to exert the 'adequate touch' has to do with the particular mechanical characteristics of the knuckle. But the reasons behind the physical characteristics of this joint can be better understood when the differences between the actions of the two instruments are examined. In this form the particular hand-finger mechanics which would enable the performer to attain a wider variety of touches when playing on each instrument might become clearer.<sup>68</sup>

The keys of the clavichord and the harpsichord can be activated in two forms:

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quill next to the string. It also allows the finger to manipulate the quill through the key. But the continuous presence of its weight also affects touch. See the discussion below.

<sup>66</sup> Bach, *Versuch*, Introduction, § 15. The term *schmeichlen* has proved difficult to translate. Mitchell translates the first part of the passage as '[t]he clavichordist grows too much accustomed to *caressing* the keys' (my emphasis), while Speerstra suggests: '[o]ne becomes so accustomed through continuous playing on the clavichord to treating the keys far too gently'. See Speerstra, *Bach and the Pedal Clavichord*, 83. The word is etymologically related to, among other words, *reiben* (i.e. to rub, to stroke). This verb appears to correspond to a type of more passive finger action than that necessary when playing on the harpsichord. See also the discussion below. I am grateful to Christopher Hogwood for suggesting the term 'to stroke', which more appropriately defines the character of the movement of the finger.

<sup>67</sup> Bach, *Versuch*, Introduction, § 15. Emanuel Bach's statement that 'one needs the clavichord in the learning of good performance, and the harpsichord in order to obtain the necessary finger strength' (Ibid.) reinforces the idea that it is on the clavichord that finger suppleness is to be acquired. This passage thus suggests that an ability to exert force, particularly from the knuckle, was taught independently from suppleness and at a later stage of the study of the keyboard. See below, p. 135–136; see also above, note 64; and chapter 2, pp. 104–105. Marpurg recommends beginners to practice on the harpsichord (though on a lightly-quilled one, or using only one register) in order that their fingers gradually begin to gain the necessary strength required in keyboard playing. See Marpurg, *Anleitung Zum Clavierspielen*, Introduction, § 4.

<sup>68</sup> The following discussion is a summary of that found in Erasmo Estrada, "'Man Gewöhnt Sich... Die Tasten Gar Zu Sehr Zu Schmeilchen': Some Considerations on Touch at the Clavichord," in *De Clavicordio XI: Proceedings of the XI International Clavichord Symposium, Magnano, 3-7 September 2013*, ed. Bernard Brauchli, Alberto Galazzo, and Judith Wardman (Magnano: Musica Antica a Magnano, 2014), forthcoming.

1. With a descending movement of the tip of a finger pivoted at the knuckle and an almost motionless hand.<sup>69</sup> This approach might not provide the necessary physical energy to activate the strings and keep them sounding for as long as it is necessary. However, this can be accomplished if the finger can alone produce the energy required by the string to remain vibrating. In order for the finger to effectively withstand the string's reaction the knuckle would need to operate as a shock absorber.
2. Through a more subtle or absent finger action, a knuckle operating as a shock absorber, and minimal descent of the hand. Easy transference of arm weight is made possible when the action of the finger is limited and the knuckle is mainly used as shock absorber. A well regulated transmission of the arm's weight aided by the knuckle would assure that the force used is large enough to both activate and keep the strings vibrating.<sup>70</sup>

When examining Monsieur de Saint Lambert and Jean-Philippe Rameau views on the movement of the finger, and Forkel's idea that Bach 'is said to have played with so easy and small a motion of the fingers that it was hardly perceptible',<sup>71</sup> one can

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<sup>69</sup> This movement is mentioned by Monsieur de Saint Lambert in his 1702 treatise. When discussing the components of gracefulness, he informs us that this consists, among other things, 'of not raising the fingers too high while playing and not pressing too hard on the keys'. See Saint Lambert, *Les Principes Du Clavecin*, 42; Saint-Lambert, *Principles of the Harpsichord by Monsieur de Saint Lambert*, 74.

<sup>70</sup> This technique is particularly necessary when playing on instruments with a high string tension and/or a high key front : balance pin : tangent radio. For a discussion on this relationship and its implications in clavichord playing, see Derek Adlam, "The Clavichord as a Coupled System," ed. Nelly van Ree Bernard and Koen Vermeij, *Clavichord International* 4, no. 2 (2000): 53–55, especially 54; and Peter Bavington, "Keylever, Tangent and String—A Preliminary Analysis of Clavichord Touch and Action," in *De Clavicordio III: Proceedings of the International Clavichord Symposium, Magnano, 24-28 September 1997*, ed. Bernard Brauchli, Susan Brauchli, and Alberto Galazzo (Magnano: Musica Antica a Magnano, 1998), 61–99. An approach which calls for the use of the weight of the arm is that described by Griepenkerl in his 1819 edition of Bach's chromatic fantasia and fugue. He also points out in his text that the wrist should be at the same level as the knuckle of the middle finger. See the discussion on the effect of the level of the wrist in chapter 5, pp. 221 ff. For a translation of Griepenkerl's remarks, see Miklós Spányi, "Johann Sebastian Bach's Clavichord Technique Described by Griepenkerl," ed. Nelly van Ree Bernard and Koen Vermeij, *Clavichord International* 4, no. 2 (2000): 49.

<sup>71</sup> Forkel, *Bachs Leben*, Ch. III, 13; David, Mendel, and Wolff, *NBR*, 433. Rameau also indicates that the touch's weight should not be increased by applying force through the hand. See Rameau, "De La Mechanique Des Doigts," 17–18. On Saint Lambert, see above, note 69.



consider that Bach might have used an approach close to that described in the first place.<sup>72</sup>

The performer must consider two issues before playing the clavichord key. First, a minimum amount of force and speed must be used to set the string into vibration, while avoiding the use of an excessive force which would produce an out-of-tune sound. Second, the knuckle needs to be capable of absorbing the energy generated by the string's reaction. Otherwise, the finger may rebound and the tangent will not remain in contact with the string. The clavichord thus requires that the player refine the knuckle's shock-absorbing qualities. Developing the knuckle in this form might affect the ability to finely regulate the finger's movements in the manner required by other keyboard instruments, especially if the necessary movements to play on them are not regularly practised.

It is important to consider that the tangent and the strings will only come into contact after the key has reached a low-level position; the finger and the key will at first be involved in a free-fall movement. The key's free-fall movement is also present in harpsichord playing. However, on this instrument it will only take place after the string has been plucked. This implies that the string will begin to sound when the key is at a higher level than that of the clavichord during the same event. Furthermore, before the free fall can take place the finger has to overcome the quill's physical resistance. In theory the necessary amount of energy for bending a particular quill will always be the same.<sup>73</sup> However, the amount of time between the quill's initial contact with the string and the plucking event can be extended at the player's discretion. The quality of the sound will be affected by this prolongation because the string may vibrate in a variety of forms depending on the amount of the displacement of the string from its rest position before it is plucked. A finer manipulation of the string's position might be achieved through a descending movement of a finger pivoted at the knuckle. An almost motionless hand, rather than using a highly shock-absorbing knuckle with minimal or absent finger action, could also contribute to the refinement of the movement.

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<sup>72</sup> This idea is also based on the possible influence that the practices of French performers had on Bach, particularly in relation to an avoidance of unnecessary body movements. See below, pp. 148 ff.

<sup>73</sup> When considering a hypothetically constant elasticity of the quill.

In all, the particular approach required by each instrument might be behind Emanuel Bach's reasons for considering the clavichordist's touch as unsatisfactory for the purposes of harpsichord playing. However, the harpsichordist could also be mechanically limited when performing on the clavichord due to his or her lack of the touch variety required at this instrument. This limitation might be also behind Emanuel Bach's recommendation that the clavichord is the instrument at which the keyboardist is to be judged.<sup>74</sup> This is because touch variety could be seen not only as the means by which the performance at the harpsichord is enriched. It is also something which broadens the performer's resources for the presentation of the content of the piece. In other words, it enlarges the options that lead to the 'well pondered touch' demanded by the notes:<sup>75</sup>

Der gute Vortrag ist also sofort daran zu erkennen, wenn man alle Noten [...] durch einen nach dem wahren Inhalte des Stücks abgewognen Druck [...] hören läßt.

A good performance is to be immediately recognised when one lets all the notes [...] to be heard [...] through a touch that has been pondered after the true content of the piece.

Bach's ultimate judgment of the performer's playing is musical. For this reason, he emphasises the idea that the keyboardist must be technically competent and able to use these resources to reveal the true content of the piece,<sup>76</sup> whatever the instrument at which the performance would take place. In other words, he or she should be in the position to produce—in any given instrument—both a sound of a required length and the necessary force to make the string sound according to the timing and expression needs of the piece. This is perhaps the meaning behind Bach's observation that:

Das Anschlagen der Tasten oder ihr Druck ist einerley. Alles hängt von der Stärke oder von der Länge desselben ab.

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<sup>74</sup> Bach, *Versuch*, Introduction, § 11.

<sup>75</sup> See above, pp. 115–116.

<sup>76</sup> Something he makes especially clear in the first paragraph of the *Versuch*'s chapter on performance.

One refers to the same thing when speaking of attacking the keys or touching them. Everything depends in equal proportion on the force or the duration.<sup>77</sup>

The components of touch, namely, the attack of the key and the knowledge of the musical content, become thus the principles of an intentional manipulation of the key which is to be attained through upbringing, education, attentive listening to others' performances and careful attention to one's own playing. It is through an experience within a cultural universe that the performer will gain an idiosyncratic capacity to discern the nuanced touch required to balance two central elements of performance: loudness and sound length.

That Forkel expresses astonishment at Bach's definition of touch<sup>78</sup> is perhaps to be also attributed to the pedagogical practices of an age in which music began to lose its previous place as an element of education.<sup>79</sup> This situation was to have a particular impact in the learning and experience of music since singing was no longer the basis of music education. This had as a consequence a bodily experiential loss and a detachment from a specific musical intention that in the particular case of Forkel and his contemporaries was related to worship within Lutheran society.<sup>80</sup>

### **A note on the finger-knuckle relation**

When the finger moves from the knuckle, the latter serves as an axis. But, as suggested above, this joint can also work as a shock absorber. This characteristic of the knuckle is essential when playing on the clavichord.

The string's reaction to the force applied by the tangent will have the finger as its final end.<sup>81</sup> If the knuckle cannot effectively absorb the string's energy the finger will

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<sup>77</sup> Ibid. Performance, § 17. My translation. Here, the term *Anschlag* is defined by the complement 'der Tasten' which delimitates its meaning. Thus, in this particular instance it is related to the handling of the key. For other possible meanings of the term *Anschlag*, see notes 5 and 23 above.

<sup>78</sup> See above, p. 111.

<sup>79</sup> For a discussion regarding Forkel's views on the state of music during the end of the eighteenth century, see John Butt, *Music Education and the Art of Performance in the German Baroque* (Cambridge: Cambridge University Press, 1994), 187–191. One should also consider that Emanuel Bach's definition of touch is presented in a text written in a historical period in which the clavichord was already considered by a number of musicians as a performance instrument *per se*.

<sup>80</sup> For a brief discussion on the issue of religious intention in keyboard performance in the practice of J.S. Bach, see appendix 4.

<sup>81</sup> This is a consequence of the string's kink, i.e. the string's mechanical reaction to the tangent's impact as a result of the string's abrupt spatial displacement. The kink manifests itself as a wave-like

rebound. In other words, a joint providing inadequate shock-absorbing qualities (e.g. when the fingers are stretched)<sup>82</sup> or not well developed (e.g. when the joint is muscularly poorly supported) will be unable of dealing with the string's physical reaction. Consequently, the player might feel the need to increase the force applied by the finger to counteract the string's reaction. In all, players might be lead to think that the force required to play the clavichord's key is greater than that really necessary if they are unaware of the knuckle's role and relevance in supporting the finger. Furthermore, the development of the fine motor ability essential to produce subtle dynamic nuances might thereby be hindered.

Carefully taught pupils may gradually have acquired the fine control of the knuckles that helped them to nuance the amount of force applied to the key. And by playing on different clavichords they might also have acquired a subtler physical ability that was probably to permit a handling of the string's reaction under various circumstances (i.e. those determined by the key's ratio,<sup>83</sup> specific weight balance, and size). Thus, the performer would have been in the position to exploit the instrument's dynamic resources in an eloquent form. Finally, this particular finger control from the knuckle seems to have helped players to adapt in a more easily form to the individual touch of other keyboard instruments, and to explore it in a more versatile manner.

The particular fine motor control and strength gained by the knuckle in clavichord playing seems to have laid the foundation for the development of the touch necessary at the organ. At the same time, the clavichord's touch seems to have helped some to refine their handling of the harpsichord's quill.<sup>84</sup> Yet, the particular touch requirements of the organ and the harpsichord seem to have called for important

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travel of the force through the string's length which starts on the point in which the tangent struck the string. Once it reaches the string's end it returns to the point of impact. The wave causes then a whipping effect that pushes the tangent downwards. For a discussion of the behaviour of the string on the clavichord, see Bavington, "Keylever, Tangent and String—A Preliminary Analysis of Clavichord Touch and Action," 61–99, especially 66 and 90.

<sup>82</sup> Quantz, *Versuch*, section VI, § 18. Jakob Adlung and Emanuel Bach also observe that stretched fingers have no place in keyboard playing. On Adlung, see David, Mendel, and Wolff, *NBR*, no. 358c, 365; on Bach, see Bach, *Versuch*, Ch. I, Fingering, § 12.

<sup>83</sup> I.e. that defined by the distances between the key front, balance pin and tangent. See Adlam, "The Clavichord as a Coupled System," 54.

<sup>84</sup> 'The competent clavichordist brings [a varied touch] to the harpsichord'. Bach, *Versuch*, Introduction, § 15.

adjustments of the physico-mechanical approach attained on the clavichord, especially with regard to the use of the knuckle.

Emanuel Bach points out that the harpsichord is needed to develop the strength (*Kraft*) of the finger.<sup>85</sup> This particular finger strength seems to refer to a specific ability to exert force upon a key carrying the weight of a jack since, in Bach's opinion, those who play only the clavichord will not be able to exert the necessary pressure to operate the jacks.<sup>86</sup> This idea not only confirms that there is a significant difference between the touch characteristics of these instruments, one that is defined by the way in which the key's weight is felt by the finger throughout the time in which this is in contact with the key. It also supports the idea that, in each case, there should be a specific form of control of the finger from the knuckle.

Bach's specifies that the harpsichord's key should offer some resistance to the finger and that the weight of the jacks should be that which would help the finger to rise, in order to release the key, once the finger is relaxed.<sup>87</sup> At the same time, he seems to have favoured a somewhat light quilling, something which was to reduce the force necessary to press down the key.<sup>88</sup> When one considers both issues next to Bach's requirement that the key must not be too heavy—i.e. too difficult to depress<sup>89</sup>—one will find that the finger would still have to press against a weighted key all the way down from the key's rest point to its deepest one. In other words, the touch resistance offered by the harpsichord's key not only results from the quill's resilience, though it plays an important role in how the performer's ability to manipulate the key is developed; the jack will exercise a force against the finger from its rest point and throughout the time the finger remains in contact with the key. On the clavichord, on the other hand, the initial resistance of a light key will be followed by a free-fall movement of the finger (see above). These contrasting playing conditions would have called for a differentiation in the use of the knuckle:

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<sup>85</sup> Ibid. Introduction, § 15. My translation. For the complete quote, see above, note 67.

<sup>86</sup> Ibid. Introduction, § 15. Although Emanuel Bach does not expressly state it, the resistance offered by the quill seems to be considered as an element of the jack's weight. See the discussion below.

<sup>87</sup> Ibid. Introduction, § 13.

<sup>88</sup> Emanuel Bach points out the qualities of quilling in the *Versuch*, Introduction, § 13.

<sup>89</sup> Ibid. Introduction, § 13.

1. In harpsichord playing the knuckle supports the transmission of the necessary force to manipulate and overcome the quill's resistance. If one would consider a situation in which the hand remains still, the curved finger moves up and down from this joint. Thus, it is also here that the finger will find its spatial support when applying force to the key. The knuckle's support begins when the key's initial resistance has to be overcome, and it continues during the time the finger remains pressing down the weighted key.
2. On the clavichord, the force transmission at the upper level of the key is limited to the impulse required to overcome the initial resistance of the key. Immediately after that, and while the finger falls down as a result of the initial impulse and the force of gravity, the knuckle would have to remain relaxed. The knuckle would finally be required as a shock absorber in order to support the finger at the moment in which the tangent touches the string. If the string needs to be kept sounding the knuckle will have to support the finger's continuous force transmission at the key's lowest position. If the *Bebung* is required the finger would need to apply extra force to the key. In this playing situation the finger can be moved up and down from the knuckle—in a similar form as in harpsichord playing<sup>90</sup>—or pressure can be applied from the hand by fixing the joint.

It is clear then that the knuckle's need to fulfil different functions would have required, as Emanuel Bach states, specific and careful practice on individual instruments. Consequently, the particular form in which the knuckle is developed on the clavichord might be behind his statement that the clavichord player is accustomed to stroke the keys.<sup>91</sup>

Before discussing some possible individual characteristics of J.S. Bach's touch it is necessary to emphasise the need to establish a clear distinction between Emanuel

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<sup>90</sup> Needless to say, when using the *Bebung* the finger's spatial displacement will be smaller than that necessary in harpsichord playing. But the energy required to displace the string at the lower end of the key might be larger as a result of the tension of the string. In any case, the spatial point in which the force is required is different in both instances.

<sup>91</sup> See also above, note 66. For a thorough analysis of the origin of this differentiated touch in the finger's biomechanical characteristics and the instruments' actions, see Estrada, "Man Gewöhnt Sich...".

Bach's touch and that of his father. Emanuel Bach's recommendations might indeed contain, to some extent, traces of J.S. Bach's views. However, a consideration of the organological characteristics of the instruments both came across throughout their lives, the place the clavichord occupied in the practice of both musicians, and Emanuel Bach's need to develop a style of his own,<sup>92</sup> suggests that Emanuel's touch might have differed significantly from that of his father. The contents of the *Versuch* may, thus, primarily reflect Emanuel Bach's own needs rather than those of his father.

### **J.S. Bach playing technique: some considerations**

At the turn of the eighteenth century the clavichord might primarily have been considered the instrument where organists would teach and practice for a subsequent performance at the organ.<sup>93</sup> Actual performance did indeed take place at this instrument. However, both within the organist's professional sphere and at secular spaces where the instrument could be found, the use of the instrument tended to be of a private kind. The instrument's limited sound output entailed a necessarily restricted social impact of these performances. But despite this limitation, it was to become particularly useful within the organist's sphere: it is at this instrument that the organist was to gain an impression of the potential effect of a performance that would later take place at the organ. Needless to say, a great deal of experience on both instruments was necessary in order to be in the position to attain this ability when playing on the clavichord.

The still widespread opinion that the clavichord was the instrument at which beginners should start the study of keyboard playing suggests that during Bach's lifetime the instrument continued to be seen and approached by many organists as an organ, however large its presence within the secular society already was.<sup>94</sup> The pedal

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<sup>92</sup> 'Both [Emanuel and Wilhelm Friedemann Bach] confessed frankly that they had been necessarily obliged to choose a style of their own because they could never have equalled their father in his style'. See Forkel, *Bachs Leben*, Ch. VII, 44; David, Mendel, and Wolff, *NBR*, 458.

<sup>93</sup> George B. Stauffer considers that 'Bach might have viewed organ playing as a distinct subcategory of clavier playing, rather than as an equal art'. See George B. Stauffer, "J.S. Bach as Organ Pedagogue," in *The Organist As Scholar: Essays in Memory of Russell Saunders*, ed. Kerala J. Snyder (Stuyvesant, NY: Pendragon Press, 1994), 36.

<sup>94</sup> In the German territories the expansion of the clavichord's role in public performance during the eighteenth century might have been connected with both the decline of the Lutheran cantorates and

clavichord was the kind of instrument at which the organist might ideally have exercised his private activities. This instrument seems to have been in many respects organologically similar to other contemporary clavichords, something which suggests that at the turn of the eighteenth century organists were playing on these instruments interchangeably. Fretted and unfretted instruments seem also to have coexisted at this historical period. In hindsight, the implications of the differences between both types of instruments are easy to see. Yet, it is possible that at the end of the seventeenth century, a time in which the fretted instrument was probably still the most common type of clavichord, performers were to use the touch developed at the fretted instrument to play on the unfretted one.

Starting from a consideration of the background described above, and taking into account Emanuel Bach's statement that his father's instruction 'may well have been designed for an organist and nothing more',<sup>95</sup> J.S. Bach's basic touch may have been that which allowed smooth playing on a fretted instrument. This touch might also have been the basic physico-mechanical approach he used when playing the organ and unfretted clavichords. This specific approach to the keyboard instrument is nothing other than a non-legato touch that could be gradated for the purposes of articulation contrast.<sup>96</sup> Since no contemporary reports are available regarding the basic touch Bach used on the clavichord and the precise organological characteristics of his clavichords, it would be difficult to try to establish if he indeed adopted a different approach when playing on an unfretted instrument.<sup>97</sup>

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the changes taking place in the domain of secular performance. The clavichord seems also to have gained the attention of the emerging 'amateur' musician as it was an inexpensive, easy to maintain, and musically versatile instrument.

<sup>95</sup> David, Mendel, and Wolff, *NBR*, no. 395, 398.

<sup>96</sup> See Siegbert Rampe, "Saitenklaviere: Clavichord, Cembalo, Spinett, Lauten-, Gamben- Und Hammerklavier," in *Bachs Klavier- Und Orgelwerke: Das Handbuch*, ed. Siegbert Rampe, vol. 1 (Laaber: Laaber-Verlag, 2007), 291.

<sup>97</sup> Bach's estate reveals that he possessed a significant number of clavichords. However, there is not a single clue as to their particular characteristics. For a discussion on the possible meaning of the indication '3. *Claviere nebst Pedal*' in the specification of Bach's estate (David, Mendel, and Wolff, *NBR*, no. 279, 255–256), see Rampe, "Saitenklaviere," 305–306. It is here my presupposition that the term *cantabile*, in the title page of the *Auffrichtige Anleitung*, has no direct relation to a specific touch (e.g. a legato one). For a brief discussion on the possible implications of the term in Bach's musical practice, see chapter 4 below, pp. 170 ff.



That J.S. Bach's basic approach, and possibly also that of Emanuel Bach, was non-legato seems to be supported by some information found in a letter from Emanuel Bach to Forkel (10 February, 1775) in which he tells him that

[t]he two sonatas, which met with your special approval, are the only ones of this kind which I have ever composed. They are connected with the one in B minor, which I sent to you, with the one in B flat, which you now have also, and with two out of the Hafner-Württemberg Collection; and all six were composed on a Claviacord [sic] with the short octave, at the Töplitz baths, when I was suffering from a severe attack of gout.<sup>98</sup>

Given the presence of a short octave this instrument was probably a fretted one. But while Emanuel Bach finds it worthy to report this fact no mention is made of the instrument's touch requirements. This since the touch needed to play on it was probably the same as that used in unfretted instruments. For Emanuel Bach the adaptation to the fretted instrument's touch was then probably not an issue as his basic clavichord touch might still have been a non-legato one.

Variations in both the key front : balance pin : tangent ratio and the tangent's striking point have an impact in the way in which the knuckle operates.<sup>99</sup> Thus, gradations of the knuckle's shock-absorbing qualities are necessary to attain the degree of necessary control called for by the firmness of the touch of particular instruments and the effects of diverse tangent velocities. But, in general, these gradations are variations of a basic approach to the clavichord's action, namely, that arising from a specific finger control from the knuckle. On the other hand, changes in the keyboard idiom, probably prompted by the exploration of the keyboard medium, were to call, in some instances, for a re-exploration of the physico-mechanical approach to the instrument. For instance, the enlarged role of the thumb was to facilitate the playing of more elaborated polyphonic music; this situation might have called for a degree of melodic clarity whose production depended, to a large extent, on the muscular control of the finger and the dexterity of the knuckles.

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<sup>98</sup> The letter is quoted in John Shedlock, *The Pianoforte Sonata: Its Origin and Development* (London: Methuen & Co., 1895), 93–94. For a discussion regarding the idiomatic characteristics of the pieces composed on this instrument, see Schulenberg, "When Did the Clavichord," 9–11.

<sup>99</sup> For a description of the two most frequent variations in clavichord building during the eighteenth century as well as the implications for touch, see Adlam, "The Clavichord as a Coupled System," 54.

The sound use of the withdrawing of the finger in the direction of the palm seems also to have been one of the basic precepts of Bach's technique. The teaching of its use, I suggest below, seems to have been at the centre of Bach's keyboard study programme. It is important to emphasise again at this point that the withdrawing of the finger was either forced by the player or a result of the relaxation of the finger after this had played. The first manner was to be used during the playing of slow- and moderate-tempo lines; the second was to aid in the playing of fast passages where a distinct clarity of sound was required.<sup>100</sup> In slow- and moderate-tempo passages, the withdrawing movement of the finger resulted from the natural tendency of the finger to move in the direction of the palm of the hand.<sup>101</sup> The movement was probably to be aided by the force provided, in its way upwards, by the released key. On the other hand, a fine degree of control would have been necessary when the finger was to be retracted in a deliberated form. This control is important since it will allow the performer to manipulate the key's speed release for the purposes of the quality of the note's ending as well as its length. In all, the release of the key resulting from the use of this movement appears to have been a major preoccupation in Bach's practice and, most probably, teaching.

The knuckle has also to support the finger's return to its rest position, namely, to the spatial location above the key before this is struck. If one follows Rameau's precept that the finger's movement begins at its root, it is then the knuckle that is at the centre of this spatial repositioning.<sup>102</sup> In order to minimise the effect of the finger's movement on the hand the finger would need to be kept as close to the key

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<sup>100</sup> The extent and form in which Emanuel Bach used the forced form of finger withdrawing may have significantly differed from those of his father as a result of the different performance circumstances each of them encountered during their lifetime. These circumstances were in part a result of changes in musical composition, instrument organology, and the characteristics of the venues in which performances took place. Thus, I suggest it is necessary to reassess Forkel's views in order to establish if he considered all these aspects when making his association of Emanuel Bach's physico-mechanical approach to that of J.S. Bach, or if he only advanced it on the grounds of father-and-son closeness. This is a topic that would require another study.

<sup>101</sup> In a healthy person the fingers will tend to flex unaided once the *extensor digitorum communis* muscle, responsible for the extension of the fingers, is relaxed. This will happen even without the *flexor digitorum profundus* muscle, responsible for flexing the metacarpophalangeal and interphalangeal joints, being brought into operation.

<sup>102</sup> '*Le mouvement des doigts se prend à leur racine, c'est-à-dire, à la jointure qui les attache à la main, & jamais ailleurs [...]*' (The movement of the fingers begins at their root, that is to say, at the point where they join the hand, and never anywhere else [...]); Rameau, "De La Mécanique Des Doigts," 17. Both the key and the muscles in the arm would help in the process of shifting the finger back to its rest position. In this process the knuckle would serve as an axis.

as possible. Therefore, the impression that Bach's hands barely moved might have been created by both his subtle control of the fingers and the fingers' continual closeness to the key.<sup>103</sup> The closeness of the finger to the key in conjunction with the fine use of finger movement from the knuckles probably also helped in the development of a distinct sensitivity of the finger's tip that would have allowed performers to explore in a broader form the instrument's aural resources. Considering everything, it is probable that a considerable amount of time was needed to achieve a high degree of mechanical finesse.<sup>104</sup>

### Keyboard organology and the development of finger action

There are three aspects of the organology of the keyboard that might have played an important role in the development of a quiet hand: the use of a keyboard with a significantly narrower natural key than that present in other contemporary keyboards; the presence of short-length keys in organ keyboard manuals; and the choice to furnish keyboards with chromatic-key blocks with trapezium profiles<sup>105</sup> rather than with squared ones. As I will argue below, the presence of these features in some instruments in Bach's day may have aided in a reduction of the movements of his hand and fingers.

In his *Musica mechanica organoedi* Jakob Adlung (1699–1762) criticises what he considers the excessive length and width of the keys in some organs. He argues that playing could become particularly difficult in a keyboard displaying wide keys since these would oblige the player to overstretch his or her fingers. As a consequence of

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<sup>103</sup> The recommendation to play close to the key is found in authors from Santa María to Marpurg. Both authors recommend that the key is not attacked too hard so that the sound of the string is not distorted. See Santa María, *Arte*, f. 38 r.; translation in Sachs and Ife, *Anthology of Early Keyboard Methods*, 11; and Marpurg, *Die Kunst Das Klavier Zu Spielen*, 8, § 14. The French *clavecinistes*' indication to play close to the key might in part have been intended to help to achieve a finer degree of control over the sound. See, for instance, one of François Couperin's remarks on touch: '*La Douceur du Toucher dépend encore de tenir ses doigts le plus près des touches qu'il est possible*' (Delicacy of touch also depends on holding the fingers as close to the keys as possible). See Couperin, *L'Art de Toucher Le Clavecin*, 7; English translation in Tunley, *François Couperin*, 137. Socio-political issues might also be behind this indication. See below.

<sup>104</sup> Forkel's report that Bach made his students practice 'for months together, nothing but isolated exercises for all the fingers of both hands, with constant regard to [his] clear and clean touch [...]' speaks for the difficulty involved in acquiring Bach's required finger control and versatility of touch. See Forkel, *Bachs Leben*, Ch. VII, 38; David, Mendel, and Wolff, *NBR*, 453.

<sup>105</sup> The chromatic key blocks are tapered in their width, namely, the top is distinctly narrower than the bottom of the block.

this situation the performer might not be able to play assuredly.<sup>106</sup> In 1768 Johann Friedrich Agricola (1720–1774) added an extensive footnote to the paragraph containing this critique. In it, he indicated that Bach preferred short-length keys in the organ—in order to facilitate and reduce the movement of the hands from one manual to the other, as well as to avoid stretching the fingers—and a trapezoidal-shape chromatic key.<sup>107</sup> It is also in this footnote that Agricola makes particular mention of the narrower keys of some instruments in the region of Brandenburg (*Mark*). This piece of information has already been connected to the presence in Berlin of the instrument builder Michael Mietke (1656/71–1719). Mietke's extant harpsichords show a clearly narrower natural key than that recorded for other contemporary instruments—including French ones, well known for their small three-octave span (*Stichmass*):<sup>108</sup>

- Mietke 1710 (Hudiksvall, Sweden), *Stichmass*: 472 mm.<sup>109</sup>
- White Mietke, 1719, *Stichmass*: 466 mm;<sup>110</sup> Sheldon reports 469.5 mm.<sup>111</sup>
- Albert Delin 1750, (Musikinstrumenten Museum, Berlin), *Stichmass*: 471 mm.<sup>112</sup>
- Taskin *Stichmass* ('standard measurement'), 475 mm.<sup>113</sup>

The small dimensions of the key in French instruments were perhaps in part a response to a socio-political attitude towards the body. The taming of dance in France during the sixteenth- and seventeenth centuries led to a more sophisticated

<sup>106</sup> 'Ein großer Fehler ist auch, wenn die Claviere nicht die ordentliche Länge haben; sondern wenn auf einer Orgel eine Oktave so groß ist, muß man, auf der die Finger weitere ausperren, oder auf einer andern sie zusammen ziehen. Man kann daher nicht gewiß spielen, bis man solcher Orgel erst gewohnt ist'. In Jakob Adlung, *Musica Mechanica Organoedi* (Berlin: Friedrich Wilhelm Birnstiel, 1768), § 349.

<sup>107</sup> Ibid. § 349; David, Mendel, and Wolff, *NBR*, no. 358, 365.

<sup>108</sup> For a discussion on the instruments by Mietke and their relation to Bach, see Sheridan Germann, "The Mietkes, the Margrave and Bach," in *Bach, Handel, Scarlatti: Tercentenary Essays*, ed. Peter F. Williams (Cambridge: Cambridge University Press, 1985), 119–148, especially 129; and Andreas Kilström, "A Signed Mietke Harpsichord," *FoMRHI Quarterly* 64 (1991): 59–62.

<sup>109</sup> In *ibid.* 60.

<sup>110</sup> In Howard Schott, ed., *The Historical Harpsichord: A Monograph Series in Honor of Frank Hubbard*, vol. 4 (Stuyvesant, NY: Pendragon Press, 2002), 173.

<sup>111</sup> In Germann, "The Mietkes, the Margrave and Bach," 129 and 145.

<sup>112</sup> In Friedrich Ernst, "Four Ruckers Harpsichords in Berlin," *The Galpin Society Journal* 20 (1967): 64.

<sup>113</sup> See Boalch, *Makers of the Harpsichord and Clavichord*, 653, remarks on the 1786 single-manual harpsichord by Pascal Taskin, Victoria & Albert Museum, London.

and controlled use of the body. Dances became much slower, the movements involved in them less brusque. There is evidence that suggests that this situation was largely a consequence of the demands for a more refined behaviour in court. This situation was to affect the bodily manner and posture of musicians such as Chambonnières. What the impact was on the activity of the performer's body at the instrument remains to be explored. However, the regulation of the movements of the dancing body and its impact on the music (e.g. ornaments began to include shorter-value notes) were perhaps to call for a more nuanced physical attitude of the musicians' body during performance. This situation, I suggest, might have led to a reduction of the playing movements and, as a consequence, to the request for smaller keys on instruments.<sup>114</sup> But the presence of similar dimensions in instruments built in the German territories, in contrast, was probably a consequence of the influence of the French culture in the courts of these lands. The appeal of these instruments to German courts may have been then a response to an addiction to 'all things French'.<sup>115</sup> This leads to a consideration that the motivation behind this size-reduction process in Mietke might have initially obeyed a commercial interest, namely, to capitalise on the demand for French instruments.<sup>116</sup> Nevertheless, the high esteem in which his instruments appear to have been held by some performers seems to reveal an appreciation of their musical, and, possibly, organological, qualities rather than of an agreement with the potential socio-political intentions behind them. This is perhaps the case of an instrument Mietke built and sold to the court at

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<sup>114</sup> On the control of the body in sixteenth- and seventeenth-century France, see Kate Van Orden, *Music, Discipline, and Arms in Early Modern France* (Chicago: University of Chicago Press, 2005), 100–102; Georges Vigarello, "The Upward Training of the Body from the Age of Chivalry to Court Civility," in *Fragments for a History of the Human Body, Part Two*, ed. Michel Feher, Ramona Naddaff, and Nadia Tazi (New York: ZONE Books, 1989), 148–199, especially 176–184; and Susan McClary, "Unruly Passions and Courtly Dances: Technologies of the Body in Baroque Music," in *From the Royal to the Republican Body: Incorporating the Political in Seventeenth- and Eighteenth-Century France*, ed. Sara E. Melzer and Kathryn Norberg (Berkeley and Los Angeles: University of California Press, 1998), 85–112, especially 88–102.

<sup>115</sup> See Eda Sagarra, *A Social History of Germany: 1648-1914* (New Brunswick: Transaction Publishers, 2009), 23–24.

<sup>116</sup> See Edward L. Kottick and George Lucktenberg, *Early Keyboard Instruments in European Museums* (Bloomington: Indiana University Press, 1997), 70. See also John Koster, "The Harpsichord Culture in Bach Environs," in *Bach Perspectives: The Music of J.S. Bach, Analysis and Interpretation*, ed. David Schulenberg, vol. 4 (Lincoln: University of Nebraska Press, 1999), 65.

Köthen, a commercial transaction in which Bach seems to have been involved.<sup>117</sup> Although it is not documented, Bach's opinion of Mietke's instruments was probably taken into account before the deal was closed. In any case, it appears that the assessment on Mietke's instruments by a number of professional musicians might have played a significant role in the decision to buy this instrument.<sup>118</sup> The presence of Mietke's harpsichord at Köthen's court seems to have had an impact on Bach's musical production.<sup>119</sup> However, it remains to be explored how, as a result of the smaller size of the instrument's keys and the probable reduction of the necessary movements during playing, if at all, his views on performance changed.

It is possible that, at least for a number of years, Bach might have found that an instrument displaying small-dimension keys offered various suitable conditions for his individual playing.<sup>120</sup> The small dimensions of the natural-key's length and width were, however, not the only aspect of the keyboard design which seems to have played a role for him. Adlung speaks also of Bach's requirement that the chromatic-key should have a tapered profile. Perhaps not surprisingly, the profile of the chromatic-key blocks in the harpsichords by Mietke at Schloss Charlottenburg (Berlin) is trapezoidal, something which would have satisfied Bach's above-named requirement.<sup>121</sup> The reason behind this particular demand is not quite clear. In my opinion, the choice of a key block tapered in its width responds to a wish to gain

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<sup>117</sup> See Christoph Wolff, *Johann Sebastian Bach: The Learned Musician* (New York: W.W. Norton & Company, 2000), 209; and Peter F. Williams, *J.S. Bach: A Life in Music* (Cambridge: Cambridge University Press, 2007), 130.

<sup>118</sup> On this issues, see Germann, "The Mietkes, the Margrave and Bach," 125.

<sup>119</sup> For a discussion of the possible influence of Mietke's instruments in J.S. Bach's musical production, see George B. Stauffer, "'This Fantasia ... Never Had Its like': On the Enigma and Chronology of Bach's Chromatic Fantasia and Fugue in D Minor, BWV 903," in *Bach Studies*, ed. Don O. Franklin (Cambridge: Cambridge University Press, 1989), 180–181.

<sup>120</sup> The instrument known as the *Bach-cembalo* (at the Musikinstrumenten-Museum, Berlin, cat. no. 316) shows a 490 mm. *Stichmass* and a 45 mm. natural key-plate length. These measurements might seem to conflict with Adlung and Agricola's remarks. However, one has to take into account that Adlung's *Musica mechanica* might have been completed by 1726. See George J. Buelow and Quentin Faulkner, "Adlung, Jakob," *Grove Music Online* (Oxford University Press, 2012); and Koster, "The Harpsichord Culture in Bach Environs," 61. Both the *Stichmass* and the length of the natural plate of this instrument are reported in Konstantin Restle, "Versuch Einer Historischen Einordnung Des 'Bach-Cembalos,'" in *Das Berliner "Bach-Cembalo": Ein Mythos Und Seine Folgen*, ed. Musikinstrumenten-Museum des Staatlichen Instituts für Musikforschung Preußischer Kulturbesitz (Berlin: Satzinform, 1995), 39.

<sup>121</sup> See the report by William Dowd in Germann, "The Mietkes, the Margrave and Bach," Appendix C, 145. Dowd indicates that the difference in width between the top and the bottom of the block amounts to 1.5–2 mm.

more control over the key during its release. This would have facilitated the use of some performance resources, particularly those related to the articulation of notes.

When one observes the profile of the chromatic-key block in Italian instruments one will find that the top of the block has often a very similar, if not the same, width as that of the lower section. This type of profile would have presented the player with a larger horizontal area where to strike the key. However, during the release of this type of key, the last moment in which the finger can remain in contact with it is marked by the time in which the finger starts to leave the upper surface of the top, or it exits the block from one of its upper edges. On the other hand, a more tapered block could have been introduced in order to help to lengthen the upwards movement of the key. This is achieved by the presence of an area on the block with which the finger could remain in contact once the finger had left the upper surface of the chromatic key. This area is precisely that of the sloping lateral sides of the chromatic block.

The presence of a sloping side on the chromatic key's block might have been particularly useful when the performer intended to play with the same finger a natural key immediately after the chromatic one while trying to reduce the length of the articulation between both notes.<sup>122</sup> In other words, the sloping sides and front were probably introduced in order to create an inclined plane area—which is not available in a squared-profile key block—which would have allowed the finger to remain in contact with the lateral surfaces of the block, thus aiding in the prolongation of the duration of the release of the key. This action may have been more easily carried out when the player's fingers were kept close to the keys. The time in which the finger remained in contact with the lateral walls of the block (during the lateral dislodgement of a finger intending to reach one of the lateral natural keys), though ephemeral in appearance, might thus have served, when skilfully used, to help to reach a natural key before the chromatic key had been completely released. In this form the articulation time could have been considerably reduced.

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<sup>122</sup> Emanuel Bach speaks in the *Versuch* about this situation without making reference to the shape of the profile of the chromatic key. Is this an indication that a large number of the instruments of the period displayed a trapezoidal profile? See Bach, *Versuch*, Ch. 1, Fingering, § 89.

During the process of drawing a picture of Bach's approach to the keyboard I decided to rely on a number of Rameau's technical indications<sup>123</sup> for two main reasons: first, Bach might have been significantly influenced in his demeanour, as well as on his attitude towards music performance, by an exposure to practices related to the French culture of his time. His stay between 1700 and 1702 in St Michael's School in Lüneburg is particularly significant in this respect since it is at this time that Bach seems to have entered in contact with Thomas de la Selle.<sup>124</sup> Selle, who was at the service of the capelle of Duke Georg Wilhelm of Celle, was dance master at Lüneburg's *Ritter-Akademie*. Selle may have provided access to some of the performances of the Duke's band, a group including a number of French musicians.<sup>125</sup> In this form he appears to have played a significant role in the development of Bach's views on the 'French musical style and manners of performance'.<sup>126</sup> Selle's influence might also have extended to Bach's relation with French dance, language and manners of deportment. Beyond this, Bach's contact with other members of Lüneburg's *Ritter-Akademie* could have helped to deepen Bach's assimilation of these and other aspects of French culture.<sup>127</sup> All these influences might have been crucial in the development of Bach's techno-mechanical approach to the keyboard, particularly in relation to the quality of the movements he employed at it. One aspect which appears to reinforce this idea is Bach's requirement for the presence of characteristic shapes and proportions on the keyboard—present, as we have seen above, on French instruments—which seem to have assisted him in the use of the reduced mobility favoured by French performers.

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<sup>123</sup> Rameau's indications were taken from *De la mécanique des doigts sur le clavessin*. Not all of Rameau's recommendations might have applied to Bach's playing, especially when considering a performance on the fretted clavichord. Rameau's indication that 'the finger which has just depressed a key is raised from it in the same instant as its neighbour depresses another [i.e. simultaneously]' can prove difficult on an unfretted instrument unless the first finger is withdrawn from the key. See Rameau, "De La Mécanique Des Doigts," 17.

<sup>124</sup> See Wolff, *Johann Sebastian Bach*, 55–57.

<sup>125</sup> See the Obituary, David, Mendel, and Wolff, *NBR*, no. 306, 300.

<sup>126</sup> See Wolff, *Bach*, 2000, 65.

<sup>127</sup> On some aspects of the relation between the St Michael's School and the *Ritter-Akademie* as well as on the possible influence of de la Selle on Bach, see Karl Geiringer and Irène Geiringer, *The Bach Family: Seven Generations of Creative Genius* (London: George Allen & Unwin, 1954), 125–126. On the influence of French dance and culture on Bach, see Meredith Little and Natalie Jenne, *Dance and the Music of J.S. Bach* (Bloomington & Indianapolis: Indiana University Press, 1991), 9–15.



Second, Forkel's reference to the use in playing of the first finger's joint (*vordern Gelenke der Finger*) has proved difficult to understand. If this is a reference (as it appears to be)<sup>128</sup> to the use of the finger's first joint, namely, the one between the distal and the intermediate phalanges, a considerable amount of time would have been necessary to attain a significant level of control for the purposes of keyboard playing. Since some of the characteristics of Bach's playing which Forkel summarizes are in striking analogy with those presented by French authors,<sup>129</sup> one is led to think that Bach's contact with French culture, as described above, could have led him to develop approaches conforming to the *clavecinistes'* contemporary practices. The description of Bach's effortless playing seems to reinforce the idea that French practices informed his playing. If so, this would suggest that Bach might have incorporated in his playing an approach in which the finger moves from the knuckle.<sup>130</sup> In all, Bach's physical approach seems to have been a result of a high level of control and relaxation, of the specific characteristics of the instrument, and the form in which the body of the performer had been shaped. The French body appears to have played a large role in the shaping of Bach's performing attitude.

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<sup>128</sup> I have tried, with limited success, to trace the exact meaning of this expression. Texts from the period use the terms *vordern*, *mittlern* and *hintern* to refer to the hand joints (*Gelenke*). An identification of the precise anatomical element to which each of these expressions refers has not been possible due to an absence of plates. See, for example, Johann Heinrich Pestalozzi, *Buch Der Mütter Oder Anleitung Für Mütter Ihre Kinder Bemerken Und Reden Zu Lehren* (Zürich und Bern: Heinrich Geßner, 1803), 18, where the terms are used. However, a number of texts use the term *vordern Gelenke* to identify the far end of the finger (i.e. the distal and the intermediate phalanges). This is, for instance, confirmed by the use of the expression '*die Enden der Finger*' (the end of the fingers (my translation)) in the same paragraph in one text where the expression appears. See Friedrich Wilhelm Daniel Snell, *Darstellung Und Erläuterung Der Kantischen Kritik Der Ästhetischen Urtheilskraft: Welcher Die Hauptpunkte Der Kritik Der Teleologischen Urtheilskraft Enthält*, vol. 2 (Mannheim: Schwan und Götz, 1792), 130. In another text the phrase '*Den Mädchen werden in der Kindheit die zwei vordern Gelenke an dem kleinen Finger der rechten Hand abgelös't [sic]*' (In their childhood the girls will have amputated the two little-finger end joints in their right-hand (my translation)) seems to more clearly establish the use of the term *vordern*. See Johann Turnbull, *Magazin von Merkwürdigen Neuen Reisebeschreibungen*, vol. 27 (Berlin: Vossischen Buchhandlung, 1806), 43.

<sup>129</sup> For a discussion on this issue, see Williams, *J.S. Bach*, 305–307.

<sup>130</sup> See above, note 102.

## 4 Playing the experimental clavichord: understanding Bach's touch

The investigation proposed in this dissertation into the origin of the evidence of wear on historical keyboards made use of an experimental clavichord (see chapter 5). It was on this instrument that a reconstruction of Bach's touch was put into use. Besides assisting in an attempt to identify the manner in which specific mechanical movements of the hand and fingers resulted in visible traces of wear this approach also aided in researching how the Inventions may have provided a suitable setting for the mastering of Bach's touch.

Before the Inventions were played on the experimental clavichord this repertoire was practiced on a number of different clavichords (displaying distinctive organological characteristics). This granted an opportunity to nuance the manner in which the finger operates on the clavichord. At the same time, playing the Inventions under these conditions not only allowed to experience and examine first-hand a number of problematic clavichord playing issues but also helped to acquire an understanding of a number of performance issues. Thus, the first part of this chapter is given to an examination of a number of organological issues which seem to have played a significant role in the development of the player's touch on the clavichord. Particular attention is given to the manner in which these were probably to affect the use of the two types of key release mentioned in the sources discussed in the previous chapter, namely, the forced (FW) and unforced (UW) withdrawing of the finger in the direction of the palm of the hand. Finally, an attempt was made to identify a number of instances in the Inventions in which, for musical reasons, the use of a particular type of touch may have been necessary.

Although the focus of the discussion that now follows is centred on the physical aspect of the act of performance one should not overlook the impact on it of socio-cultural issues that might also be relevant to the development of keyboard techno-mechanical approaches, as pointed out in chapter 3. These issues are thus probably

also significant to the study of the trace of wear on historical keyboards since the manner in which a performer's body operated could have been conditioned by how physico-mechanical approaches to the instrument were shaped within particular socio-cultural spheres. For this reason in the second part of this chapter I will briefly explore Bach's use of the term *cantabile* in the title page of the Inventions since, I suggest, this hints that Bach might have held a view that both instrumental music and singing had a similar purpose, namely, the worshiping of God. This circumstance was probably to influence the manner in which his pupils' techno-mechanical approach developed and, as a result, how performances unfolded. It is hoped that the views advanced here will encourage further research on this topic that would help to enlarge our understanding of the role of the socio-cultural element in the development of performance approaches.

### **J.S. Bach's keyboard physico-mechanical approach: a reconstruction**

An attempt to understand the traces of wear found on the keyboards of historical instruments presupposes here the use of an experimental clavichord.<sup>1</sup> The use of a clear-cut physico-mechanical approach on this instrument is of the outmost importance given the necessity to identify in a reliable form the mechanical actions explaining the present condition of the worn-out key. As already pointed out in the introduction I proposed to play on this instrument using a playing approach which comprised a number of elements that might have been present in J.S. Bach's own manner of playing. His approach has thus been reconstructed from an identification of its mechanical movements in a number of historical sources. It was thus hoped that it would help to wear the experimental clavichord key's surface in a significantly similar manner to that of historical approaches.<sup>2</sup>

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<sup>1</sup> For a description of this instrument, see the introduction, p. 10–11.

<sup>2</sup> For a thorough analysis of the effect on the key of this physico-mechanical approach, see below, chapter 5, pp. 200 ff. The resemblance between the traces of wear on the experimental clavichord and those present on historical instruments seems to confirm the mechanical proximity of the proposed reconstruction to that of those approaches used on historical instruments.

The sources in which these mechanical movements are found have already been discussed in chapter 3. Here follows a short summary of the aspects defining this technique:

1. The position at the clavichord (arm, wrist, hand, knuckles) can be observed in chapter 5, plate 5.34. An effort was made to keep the lower sides of the wrist and elbow at the same height of that of the surface of the natural keys.<sup>3</sup> The main measurements that define the position at the clavichord were:

Height of the natural key surface: 98.5 cm.

Height of the bench: 72 cm.

Distance between the front edge of the natural keys and that of the bench: 33.5 cm.

2. The fingers were curved at all times. The thumb was kept close to the front side of the natural key. The long fingers were kept in a straight line at a distance of approximately 5 mm. from the front of the chromatic key. The finger moved from the knuckle.
3. The finger was stretched to reach the chromatic key. This was played on the first third of the key top.<sup>4</sup>
4. When playing slow and moderately-fast lines the key was released by allowing the finger to relax (i.e. the FW was not used). As a result of the balance between the arm, wrist, hand, and knuckles, this relaxation allowed the finger to glide towards the palm of the hand. The distance travelled by the finger as a result of the gliding movement was not very large.<sup>5</sup>
5. When playing fast and very fast lines or groups of notes the key was again released by relaxing the finger. However, in these cases the finger was also

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<sup>3</sup> For more details on the height of the wrist when playing on this instrument, see chapter 5, pp. 226 ff.

<sup>4</sup> This considers the length of the block on the original instrument, namely, the same as that of the natural-top tail.

<sup>5</sup> For the reasons of this situation, see chapter 5, p. 233.

forced to glide on the key. This movement allows the finger to travel a distance which could be as large as  $\frac{3}{4}$  of the length of the natural key top.

6. The finger movement used to play the key was initiated only when the finger that played before had been relaxed. This resulted in a clear articulation between two sounds.
7. No abrupt movements were used while playing.

### **Bach's physico-mechanical approach in use: proposed repertoire**

In order to try to refine our understanding of the manner in which the mechanical elements in Bach's playing approach affected the key's surface three preconditions were established: 1) a number of Bach's elementary teaching materials were to be played; 2) to guarantee as much control as possible of the proposed approach the chosen repertoire was to be practiced in advanced on other instruments (clavichords); 3) to allow close monitoring of the movement of the fingers the speed of playing on the experimental clavichord was much slower than the piece's performance tempo<sup>6</sup>.

The repertoire played on the experimental clavichord was restricted to the Inventions BWV 772–786. The numerous extant copies produced by his pupils suggest that Bach seemed to have attached great importance to the study of this set of pieces.<sup>7</sup> Bach also appears to have regarded the Inventions as a basic step in his instruction program before other repertoires—such as the French suites and the Well-Tempered Clavier (*WTC*)—were introduced. The Inventions were however not for the exclusive use of beginners. There is evidence suggesting that he had also required experienced pupils to master them. One case is particularly illuminating. Heinrich Nicolaus Gerber (1702–1775), who began his studies with Bach in 1721, is known to have studied the keyboard before he received instruction from Bach. In spite of this Bach is reported to have made him practice the Inventions.<sup>8</sup> While the reasons

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<sup>6</sup> For more on this point, see below, p. 160.

<sup>7</sup> For a list of extant copies made by Bach's pupils, see Georg von Dadelsen et al., *Inventionen Und Sinfonien: Kritischer Bericht* (Kassel und Basel: Bärenreiter, 2007).

<sup>8</sup> See Ernst Ludwig Gerber, "Gerber, Heinrich Nicolaus," *Historisch-Biographisches Lexicon Der Tonkünstler* (Leipzig: Johann Gottlob Immanuel Breitkopf, 1790), col. 490–492; and David, Mendel, and Wolff, *NBR*, no. 315, 322.

behind Bach's decision are not known one is led to think that he could have found this necessary in order either to implement a specific physico-mechanical approach which Gerber might have not possessed at the time he became his pupil, or to regulate it.

The Inventions offer a number of conditions that can help to master the approach above proposed. They are not only idiomatic to the keyboard and their contrapuntal lines are easy to follow and have a clear-cut structure. They also explore, in an ingenious manner, aspects of articulation, ornamentation, and motivic elaboration which aid in the development of a number of finger skills—such as the use of the withdrawing of the fingers. All in all, the crafting of these pieces would have provided the pupil with a favourable setting for the practice of the underlying principles of Bach's approach since they display well-defined instances where the fingers should be used in particular forms. This, in conjunction with the relative simplicity of the pieces and their contrasting tempos, would also have helped to recognise the effect of specific actions of the finger on the musical outcome, something that could lead to a refinement of touch. Finally, the Inventions offer another important advantage in an inquiry into the impact of Bach's playing approach on the surface of the key, namely, they explore the most frequently used tonalities by organists of the period.<sup>9</sup> This helped to acquire a general view of the effect of the fingers on a wide tonal spectrum.<sup>10</sup>

### **Some considerations on clavichord playing**

It is important to observe at this point that I had performed the Inventions in the past. Needless to say, this situation necessarily had an impact on my view of the pieces at the time I began practicing them for the present research project. In spite of this situation, I was aware that the proposed reconstruction of Bach's approach is comprised of a number of technical issues that I previously either used in a less

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<sup>9</sup> For a discussion on the tonal spectrum of the *Clavier-Büchlein vor Wilhelm Friedemann Bach*, and, thus, for the Inventions, see Siegbert Rampe, "Sozialgeschichte Und Funktion Des Wohltemperierten Klaviers I," in *Bach, Das Wohltemperierte Klavier I: Tradition, Entstehung, Funktion, Analyse: Ulrich Siegele Zum 70. Geburtstag*, ed. Siegbert Rampe (München; Salzburg: Musikverlag Katzbichler, 2002), 71–78.

<sup>10</sup> A table containing information on the notes present on the inventions can be found in appendix 5, table A.5.2.

regulated manner than here (see below), or not at all (e.g. the FW). Thus, and in order to be in the position to use the components of the proposed approach in a rigorous manner, the pieces were practiced on other instruments before the reconstruction was put into play on the experimental clavichord. Since practice was undertaken on four different clavichords, this also allowed me to try a number of aspects of the action of the finger in various organological configurations and, therefore, to diversify the manner of use of specific finger actions.<sup>11</sup> As a result, these could be called into use in an efficient and nuanced manner without regard to the organological characteristics of a particular instrument's action. The impact on the action of the finger of two aspects of the organology of the clavichord deserve a brief comment here since these deeply influence how the knuckle operates: the keydip and the key front : balance pin : tangent ratio.

## Keydip

Variations in the keydip, even of a very small amount, can greatly affect the outcome of the action of the finger. A shallower key results in the tangent reaching the string faster. This implies that the key would need to acquire in a shorter time the necessary speed that would allow the finger to make the string sound. It is crucial then that the performer is able to control the knuckle's movements in a way that the finger can descend in a faster form without adding to the force it has to transmit.<sup>12</sup> Needless to say, this consideration is valid only when the tension of the strings, the key front : balance pin : tangent ratio, and the tangent's striking point are all the same on the instruments with different keydips. A larger keydip can, on the other hand, lead the player to apply less force than that required by the string to vibrate. The result will be blocking, that is to say, the tangent will not remain in contact with the string immediately after striking it.

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<sup>11</sup> The instruments used, all in the Edinburgh University Collection of Historic Musical Instruments, were: 1) anonymous triple fretted clavichord (possibly Nuremberg, c.1700), cat. no. 4321; 2) anonymous unfretted clavichord (possibly Dresden, c.1740), cat. no. 4487; 3) unfretted clavichord by Johann Adolph Hass (Hamburg, 1763), cat. no. 4322; 4) unfretted clavichord by Arnold Dolmetsch (London 1896), cat. no. 4323.

<sup>12</sup> A shallow key requires that the finger is accelerated in a shorter amount of time in order to acquire the necessary speed to set the string into motion. Some inexperienced players tend to accelerate the finger to a point that affects the amount of force transmitted to the string. Let us remember that force ( $f$ ) is equal to the product of the mass ( $m$ ) and its acceleration ( $a$ ). The larger the acceleration, the larger the effect of the finger's mass on the key.

When regularly playing on instruments with different keydips one may acquire an ability to control in a more refined way not only the lowering of the finger but also the release of the key. It is during the latter event that the tangent is detached from the string. Under certain circumstances, such as when the mass of the string is particularly large (e.g. in the bass register), poor control of the finger during the key's release would allow the string to briefly vibrate against the descending tangent, a situation which can lead to the presence of undesired noises. Thus, in some instances the clarity and distinctness of the ending of the note—and thus the effect of the articulation—will depend on how fast the tangent is made to leave the string. The ability to produce differentiated release speeds depends on the finer control of the finger's ascending movement. This type of control is also important when trying to keep the finger at all times as close as possible to the surface of the key, a requirement of Bach's approach.

### **The key front : balance pin : tangent ratio**

Next to the function of providing the finger with the adequate velocity to strike the string the knuckle is also central in the transmission of force. The force required to set a particular string into motion depends to a great extent on the spatial relationship between the tangent, the balance pin and the point where the finger touches the key, namely, the *key front : balance pin : tangent ratio*.<sup>13</sup> This, in conjunction with the string's mass and tension, and the positioning of the tangent's striking point, will determine the minimum amount of force necessary to make the string sound. Thus, when the player regularly practices on a number of clavichords exhibiting contrasting organological configurations involving these elements the knuckle may become capable of:

1. Efficiently transmitting force in a differentiated manner.
2. Withstanding the string's reaction (i.e. the kink)<sup>14</sup> without rebounding.

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<sup>13</sup> This is to say, the leverage of the key. See Adlam, "The Clavichord as a Coupled System," 54.

<sup>14</sup> See above, Ch. 3, note 81.



3. Helping the finger to remain in firm contact with the string throughout the duration of the note. This can prevent the need of adding unnecessary pressure that could affect tuning.

Therefore, a player capable of nuancing the knuckle's abilities to transmit force and absorb impact would be able to make the tangent strike the string solidly, to readily attain the desired volume of the note, and to ensure that the tangent remains firmly in contact with the string for as long as it is necessary. As I will argue below, Bach, from the very beginning, pursues these three aims in the Inventions.

At the centre of the ability to refine movement seems to be the avoidance of unnecessary movements, something that would also have helped performers to keep a quiet hand. The immediate consequence of this is that the manner of playing becomes more effective in the production and shaping of sound. All this is perhaps at the centre of Emanuel Bach's statement that 'it is at the clavichord that a keyboardist may be most exactly evaluated'.<sup>15</sup>

### **The playing surface's grip**

One significant issue that arose during the preparation and experimental playing of the Inventions needs to be mentioned at this point. The distance and speed at which the finger travels as a result of the use of either the FW or the UW depends to a great extent on the physical characteristics of the keytops' material. Practice was undertaken on instruments with wood and tortoiseshell keytops while the experimental playing took place on an instrument displaying plaster tops.<sup>16</sup> Hence, there was a significant contrast in the manner in which the finger operated on the various surfaces when the same finger action was used. This contrast has its origin in the differences in grip that the finger encounters on each of surface. The wood's grain adds to the grip of the playing surface. Although wood keytops are usually oiled the finger will still find certain resistance to any sliding motion. On the other hand, a loss of grip was experienced when playing on the experimental clavichord. This made the use of both the FW and UW much easier on this instrument. This

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<sup>15</sup> Bach, *Versuch*, Introduction, § 11.

<sup>16</sup> For information on the instruments used, see above, note 11.

situation appears to have been a consequence of the experimental tops' continuous release of plaster powder as a result of the high-wear rate of their composite material. This powder tended to accumulate not only on the edges of the playing surface but also on the tips of the fingers, a situation that seems to have contributed to a loss of grip.

It is important to observe that grip can also significantly vary in tops of more traditional materials such as wood and bone.<sup>17</sup> Moreover, the characteristics of the wood's grain, the amount of fat accumulated on both the top and the finger, the amount of wear already present on the surface, and the dimensions of the area of contact between the finger and the top can also considerably affect the player's feeling of grip. Therefore, one should carefully observe how the movement of the finger is affected by the surface's grip so that adjustments can be made to the finger action.

### **Playing the Inventions: some insights**

As mentioned above the Inventions seem to provide a suitable layout for the practice and mastering of the proposed Bach approach. In the following discussion on the Inventions I will concentrate on an analysis of the manner in which Bach's pupils might have become proficient in the use of the FW and UW through the use of this repertoire. The predominantly mechanical character of this discussion is expected to assist in an apprehension of the manner in which these techniques might have been used in performance. Needless to say, the outcome will vary depending on the choices of tempo and articulation, the levels of hierarchy laid down, and the performer's mechanical abilities.

The Inventions were played in the order found in Wilhelm Friedemann Bach's *Clavier-Büchlein (CB)*, namely, C major, D minor, E minor, F major, G major, A minor, B minor, B flat major, A major, G minor, F minor, E major, E flat major, D major, C minor. As I will suggest below the order of playing might be relevant for a

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<sup>17</sup> One particular instance is tortoiseshell. This is a material which offers considerable grip to the finger while appearing to have little tendency to wear. This becomes clear when examining a fretted clavichord by Hieronymus Albrecht Hass (Hamburg, 1740; in the Nydhal collection, Stockholm, cat. no. IKL047). While its mother-of-pearl chromatic tops show clear signs of wear, the tortoiseshell natural tops display very little.

number of reasons, among which the progressive study of the use of the withdrawing of the fingers might be included. The order of playing in *CB* is in clear contrast to that in the fair copy produced by Bach in Leipzig in 1723 (i.e. the *Auffrichtige Anleitung* (AA)).<sup>18</sup> Although one would expect to find the AA sequence in all the copies of this manuscript made by his pupils after 1723,<sup>19</sup> the original *CB* order can still be found in later manuscripts.<sup>20</sup> The reasons behind Bach's alternative ordering might have to do with either a change of mind about the study sequence of the pieces, or with an intention to create an association between the *WTC* and the AA. This second hypothesis arises from the idea that the AA was probably prepared to support Bach's application for the position of Cantor at St Thomas School in Leipzig.<sup>21</sup> In any case, it is probable that Bach would have requested his pupils to study the pieces in a particular order once he had defined their particular study programme.

<sup>18</sup> Staatsbibliothek zu Berlin, Preußischer Kulturbesitz, Mus. ms. P 610.

<sup>19</sup> See, for instance, the copies made by Johann Peter Kellner (1705–1772), in the Staatsbibliothek zu Berlin, Preußischer Kulturbesitz, Mus. ms. Bach P 804, 1725; and Heinrich Nicolaus Gerber (1702–1775), in the Nederlands Muziek Instituut, Den Haag, NMI Kluis F (Bachdoos n), 1725. See Dadelsen et al., *Inventionen Und Sinfonien KB*. Georg von Dadelsen and Klaus Hofmann, *Neue Ausgabe Sämtlicher Werke, V/3, Inventionen Und Sinfonien, Kritischer Bericht* (Kassel und Basel: Bärenreiter, 2007), 28 and 32.

<sup>20</sup> See the manuscript copies by Bernhard Christian Kayser (1705–1758), in the Staatsbibliothek zu Berlin, Preußischer Kulturbesitz, Mus. ms. Bach P 219, c.1724 (in which the Sinfonias are interspersed among the Inventions); and Johann Christian Bach (1743–1814), in the Staatsbibliothek zu Berlin (Amalienbibliothek), Am.B 478 m, c.1760–1780. See *ibid.* 25–27 and 33.

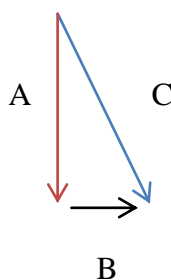
<sup>21</sup> When applying for the vacant post of Cantor in 1722 Bach might have been required by the Leipzig town council to provide evidence of his competence as a keyboard instructor. Bach would have sent those materials which appear to have been ready by the time, namely, the *WTC* (1722) and the *OB* (1722/1723). I suggest that as a result of an internal dispute between two factions in the Leipzig town council (namely, the Cantor faction—in favour of choosing a musician that could make music and instruct—and the Kapellmeister faction—which aimed to elect a musician well versed in the more modern musical currents), Bach was required to produce more evidence of his pedagogical skills in order to try to secure his final appointment. It also seems possible that the difficulty of the repertoire found in the *WTC* might have prompted some council members to ask for proof of Bach's experience teaching beginners. For another hypothesis, see below, pp. 172 ff. In either case, the AA appears to have been Bach's response to this petition. Bach seems to have tried to tie all three collections by using a similar wording in all three title pages, and by adopting the *WTC*'s order of the pieces. On the dates of the *WTC* and *OB* title pages, see Williams, *J.S. Bach*, 353. For a discussion on the possible additions to the original title page of the *WTC*, see *ibid.* 337. The date 1722 in the *WTC* might have replaced an earlier one. See Alfred Dürr, *Johann Sebastian Bach: Neue Ausgabe Sämtlicher Werke Serie V. Band 6.1 Das Wohltemperierte Klavier I. Kritischer Bericht* (Kassel: Bärenreiter, 1989), 21. The conflict between the Leipzig town council factions is discussed in Ulrich Siegele, "Bach's Situation in the Cultural Politics of Contemporary Leipzig," in *Bach's Changing World: Voices in the Community*, ed. Carol Baron, trans. Susan H. Gillespie and Ruben Weltsch (Rochester, N.Y.: University of Rochester Press, 2006), 127–173. See also David, Mendel, and Wolff, *NBR*, no. 94, 100.

Following the conclusions made in the previous chapter, and after testing the outcome of both the FW and UW when practicing the Inventions, I decided to make a discretionary use of this technique when playing on the experimental clavichord. This means that while on this instrument both types of withdrawing were used each of them was employed in specific and well-defined playing instances. It is also important to observe that on this instrument the length travelled by the finger when using the FW was kept constant. This was necessary since otherwise the use of variable lengths would have complicated the interpretation of experimental data and thus the possibility to glean more specific information in relation to the effect of the finger on the experimental top. Hence, when I refer here to the sliding of the finger on the key one should consider that the finger travelled a distance of  $\approx 6$  mm for the UW and  $\approx 2.5$  cm for the FW. In order to keep close control of these measurements, and to maintain them more or less constant, the Inventions were played at a considerably slower tempo than that commonly used in performance.<sup>22</sup>

The Inventions also provide the means by which the student's fingers may acquire full control of the force applied to the key. The need for a robust touch, based on the firmness with which the finger initially applies force to the key and then withstands the string's reaction, becomes already apparent when playing the C major Invention. Here, the initial motif requires that each of its notes sound in a round and distinct manner. In order to accomplish this, the player needs to use an attack that would initially make the tangent enter in firm contact with the string and, subsequently, help the finger to continue applying constant pressure to the key. This can be achieved through the exertion of force in an angle rather than only in a vertical form: once the tangent is firmly attached to the string the player needs to slightly pull the finger towards the palm of the hand. The simultaneous use of a vertical and horizontal force will result in a diagonal force vector. The use of this force without the finger sliding off before time is made possible by the grip provided by the keytop's surface (see table 4.1).

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<sup>22</sup> For a table including the times allocated to the playing of each of the Inventions on the experimental clavichord, see below, appendix 5, pp. 298–299.



**Table 4.1 Vector resulting from the addition of the finger's vertical and horizontal forces: A, Vertical force; B, Force in the direction of the palm of the hand; C, Resulting force.**

The use of this type of finger action does not necessarily imply that the finger is to be withdrawn forcefully once the player decides to release the key. The finger's movement in the direction of the palm (vector B) is restrained by the friction existing between the finger and the top's contact areas. This means that the length of the distance that the finger will glide once this is relaxed could be potentially larger than when the horizontal force component is absent. In any case, I suggest that an UW is to be used throughout this Invention. Short four- and five-note ascending and descending scalar movements provide a suitable frame for the practice of this finger action since, as a result of the closeness of the fingers, they prevent the appearance of tension on the muscles of the hand. Bach's use of thirds also offers the player the opportunity to experience its use in a contrasting, but still a small, interval (see figure 4.1).



**Figure 4.1 Invention in C major BWV 772, bar 1 (r.h.)**

Needless to say, the use of the UW does not exempt the player from paying close attention to the length of each note for the purposes of articulation. For instance, in bar 3 (r.h.) the articulation between the first two notes of the first and third beats on the right hand—namely, e''-a'' and g''-f''—serves as an aid to the listener to recognise the beginning of the inversion of the first motif (see figure 4.2).



**Figure 4.2 Invention in C major BWV 772, bar 3 (r.h.)**

One possible exception to the use of the UW is the playing of the two demisemiquavers in bar 6 (see figure 4.3). Here, the FW of the finger helps each of these notes to speak clearly.



**Figure 4.3 Invention in C major BWV 772, bar 6 (r.h.)**

The D minor Invention might initially have been played using an UW. In a moderate tempo this technique allows both quavers and semiquavers to be clearly heard. When playing the piece at a faster pace the use of the FW might be desirable since it helps to create a larger articulation between the notes. However, a player not well versed with this technique may develop a tense hand. Thus, I suggest that in the beginning this Invention was to be played at a moderate tempo. In this manner, the pupil would also have been able to practice the use of the UW in long scalar runs. It was perhaps at a later stage in the study of the Inventions that Bach might have required his pupils to come back to this piece and play it at a faster tempo while using the FW. This technique, as I will show below, would have been fully introduced in the F major Invention.

The E minor Invention, like the C major, offers an opportunity to practice the use of the UW in a moderate-tempo piece. Yet, the frequent appearance of ornamented notes and larger intervals, interspersed between motifs comprised of conjunct degrees and thirds, calls for a more developed ability to efficiently readjust the action of hands and fingers. One particular difficulty of this Invention resides in the more prominent use of chromatic keys, a situation which demands thorough practice of the touch control necessary to play on them.

In the F major Invention Bach seems to have been given great attention to the study of the FW. Although the first six notes—and, in general, every quaver on this

piece—are probably to be played using an UW, the sixteenth notes that follow immediately (bar 2) call for a FW. Nevertheless, the next sixteenth-note motif is perhaps intended to be played through the combined use of the UW (first note of each four-note group) and the FW (see figure 4.4).



**Figure 4.4** Invention in F major BWV 779, bar 4 (r.h.)

Sixteenth-note groups in fast-tempo pieces do not always necessarily call for the use of the FW. In bar 15, for instance, the presence of large intervals between the notes would allow each note to be clearly heard, even if the articulation is too short (see figure 4.5). A similar situation can be observed in bars 24 and 25 where the bass ascending lines *D- G A B G* and *C- F G A F* are clearly distinct when the whole passage is played while using the UW (see figure 4.6).



**Figure 4.5** Invention in F major BWV 779, bar 15 (r.h.)



**Figure 4.6** Invention in F major BWV 779, bars 24 and 25 (l.h.)

Just as in the case of the F major first-bar's motif, the long skips in the G major Invention call for the UW. There are however some situations in which the use of the FW might have been necessary to emphasise the melodic function of particular groups of notes. For instance, a number of conjunct-degree three-note groups have an upbeat function which needs to be stressed. This stress can be effortlessly achieved through the clear detachment of the notes of each group by using a FW (see figure 4.7).



**Figure 4.7 Invention in G major BWV 781, bar 4**

For sure, one may attempt to detach these notes by using the UW. In this manner only this type of key release would be used throughout the entire duration of piece. Yet, when the UW is used on this particular instance the player will soon notice that the speed of the key's release is slower than that which can be attained through the FW. A slower release might have an impact on the length of the articulation (which could be thus too short), and, as a consequence of the tangent not leaving the string fast enough, result in a less sharp ending of the note.<sup>23</sup> At the same time, the hand of an inexperienced performer might grow tired when trying to achieve a longer articulation through the use of the UW.

The A minor Invention introduces the particular problem of having to modify the manner in which the fingers attack and release the key as a result of the presence of arpeggios. When the hand moves from one octave to another in a short amount of time the touch differences throughout the various areas of the keyboard's compass might become very clear. These differences result from variations in the key ratio, the string's mass and tension, and the position of the tangent's striking point. While a similar issue was already treated in the G major Invention here the compass covered by each of the voices is much larger. Although the transitions from a lower to a higher octave (or vice versa) are gradual, in at least one case the voice descends two octaves in the space of just two beats (i.e. bar 3, l.h.).

Even if a builder has tried to make the touch on the whole instrument as homogeneous as possible, it may be inevitable that the player will encounter some touch differences which can greatly affect the outcome of a particular finger action when this is used in different octaves. Thus, once the player has become aware of these touch differences he needs not only to learn how to differentiate an attack when

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<sup>23</sup> See also the discussion below on the performance of a similar passage in the F minor Invention.



playing on different regions of the keyboard. He also needs to be able of doing this rapidly when having to switch from one octave to the other either in a gradual or abrupt manner.

In previous Inventions Bach might already have introduced the holding of some notes for the purposes of emphasis. However, it is in the B minor that he appears to demand its use in a consistent and more elaborated form. Here, the pupil has first to skilfully deal with the problems posed by two successive intervallically and rhythmically contrasting phrases requiring the use of the UW (bars 1–2 and 3–5, r.h.). The performance of the first is complicated by the presence of trills which call for carefully controlled finger speed and force. The second, on the other hand, requires that the length and volume of the first notes of each sixteenth-note group are distinctly nuanced. For instance, the  $g\sharp'$  and  $e\sharp'$  in bar 4 (r.h.) need to be slightly longer to emphasise their role as a double appoggiatura<sup>24</sup> (see figure 4.8).



**Figure 4.8 Invention in B minor BWV 786, bar 4 (r.h.)**

The first and third notes of the last sixteenth-note group in the same bar also call for a similar emphasis. Both notes are part of an ascending line which becomes more present by holding them a bit longer.

Perhaps in no other place in the Inventions does a motif call for the use of the FW as clearly as the B flat major's first group of notes on the right hand. This Invention's notation suggests a brisk tempo in a quaver pace. The FW would allow the first four notes of the group to be distinctly heard while helping to keep the hand relaxed. The use of the FW is interspersed with that of the UW. This allows the player to keep control of the hand's relaxation while practicing the FW during the early stages of keyboard learning. This also helps to develop an ability to smoothly and effortlessly move from the use of one type of action to the other. An analogous situation occurs in the A major Invention where the first bar introduces two sixteenth-note groups in

<sup>24</sup> A similar situation is found in bars 6, 13, 15, 19 and 20.

conjunct degrees followed by two more constituted of intervals of a third. The first two groups call for a FW while the following for an UW.

One could argue that, as a result of their different characters, the G minor and F minor Inventions offer the conditions for a side-by-side contrasting use of the UW. On the one hand, the G minor Invention's theme is comprised of continuous conjunct-degree sixteenth-note groups in which a number of thirds and sevenths are featured. On the other, the F minor's shows more rhythmic contrast within its motifs while also incorporating a number of ascending sixths, all of which makes this theme more expressively melodic. Thus, the emphasis and articulation requirements of these theme's notes are, just as the demands each of these Inventions pose on the player's touch, quite distinct. In spite of this situation both seem to call for the use of the UW. I suggest that the G minor Invention requires that the lines flow in a more straightforward form. However, some notes could be held to emphasise some of the outlines of the phrases. For instance, after the initial G in the bass the second bar's first note on the right hand could be briefly held to help the listener to clearly perceive the downbeat. Another instance is the third beat's first note on the same hand (*d''*). This note probably needs to be held even longer as it is the theme's highest note. Considering that this emphasis is placed on the middle of the bar, the holding of next bar's downbeat in the bass is probably desirable.

The F minor Invention seems also to call for the use of agogic accents in some instances indicated by slurs. There is no place here to explore in full some considerations related to their performance. It could be argued, however, that some of these slurs signal an instance requiring a particular articulation whose presence could greatly enhance the piece's musical outcome. Let us just briefly discuss one example. First, it is important to recall that the two earliest sources of this piece differ broadly in the amount of slurs they display. In bar 4, for instance, two short slurs, placed above the last two sixteenth-note groups, can be observed in *CB*. In *AA* a single slur groups all three beats of the bar (see figure 4.9).



**Figure 4.9** Invention in F minor BWV 780, bar 4 (r.h.)

The two slurs in *CB* are the only ones in the entire piece. This situation and the place where these are found (i.e. in the first phrase's closing bar whose last note, the leading note, does not immediately resolve to the tonic—moreover, the resolution is not on the same octave) suggest two possible reasons for their presence. They were introduced to indicate (probably for the benefit of the young Friedemann Bach) the exceptional character of the resolution of the bar's last note, and the need to perform the right-hand last two beats in such a form that the ending of the phrase would become clear to the listener. The contrasting slurring in the sources under discussion could mean either that the longer slur in *AA* was intended as shorthand for the shorter slurs,<sup>25</sup> or that Bach had changed his mind and a different procedure to that implied by the two *CB* slurs was now to be used to signal the phrase's ending. If this analysis is anything to go by, Bach's use of slurring variants in parallel passages in *AA* might imply that a different solution was available to each particular instance. Whatever the case, a nuanced use of the UW is probably central to the performance of all these passages.

At this point it is important to observe that the use of the UW in the lower register of some clavichords could at times be problematic. I have already mentioned above that the tangent's release speed is lower when the UW is used rather than the FW. This, together with the larger mass of the strings of the bass register, can lead to the presence of buzzing noises that could become particularly evident when playing passages requiring very short articulations. It is then advisable that this type of passage is initially practiced at a very slow tempo. In this form a balance between the length of the articulation and the speed of the key's release might be more easily found. In some occasions the solution to this problem would entail the use of the FW in slow and moderate tempo pieces.

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<sup>25</sup> Butt, *Music Education*, 166.

The UW is the main type of key release required in the E major Invention. There is, however, a recurrent figure made up of two demisemiquavers and a quaver whose brilliance and effect can be enhanced when its first two notes are played using the FW (see figure 4.10).



**Figure 4.10** Invention in E major BWV 777, bars 3–4 (r.h.)

Motifs and phrases, each demanding their own distinctive expression, are again ingeniously mixed by Bach in the E flat major Invention. These need to be skilfully treated, by means of touch, to shape their flow and, at the same time, the overall structure of the piece. To these musical requirements one needs to add the problem of having to handle the instrument's individual touch while playing a fast piece that makes extended use of the chromatic keys. Needless to say, failure to conform to the instrument's individual touch would result in laborious playing. This Invention thus offers a particularly favourable setting for the combined practice of a number of playing issues which demand distinct levels of relaxation of the hand such as the FW and UW, the holding of individual notes, and the performance of ornaments.

Like that in F minor, the D major Invention presents us with a number of slurring problems issuing from the differences existing between *CB* and *AA*. While in *CB* this piece does not contain a single slur, *AA* displays one in almost every bar. It has been suggested that the slurring in *AA* might have to do with Bach's wish to indicate a single accent per bar, and to prevent players from accenting appoggiaturas in the middle of the bar.<sup>26</sup> The absence of slurs in *CB*, on the other hand, is perhaps a result of Bach's particular involvement in Friedemann's training: Bach probably closely monitored his son's playing and might have corrected him mostly in an oral rather than written form. To be sure, Bach could have continued expressing orally these requirements during his pupils' lessons. For this reason, the presence of the slurs appears to suggest that he may have changed his mind at some point between the preparation of *CB* and *AA*. Just as in the F minor Invention, Bach seems to have

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<sup>26</sup> Ibid. 165.

found it necessary to indicate that particular attention needed to be paid to the particular instances where those slurs are found. Thus, the possibility that Bach sent the AA to the Leipzig town council to support his application for the position of Cantor at St Thomas not only suggests that the order of the pieces in the fair copy is the result of a wish to mirror that in the *WTC*.<sup>27</sup> It also seems to indicate that he found it necessary to clarify the accentuation for the benefit of his manuscript's probable first readers, namely, the members of the council. This would appear to explain not only the neatness of the fair copy, but also Bach's insistence in slurring almost every bar, something that makes the page visually more attractive.

The 3/8 meter of this Invention appears to call for the use of the UW. However, at this stage of the pupil's training—when he may already have been able of maintaining the hand supple at all times—Bach might have suggested trying both the FW and UW on the same piece for the purposes of creating an awareness of the effect, and musical potential, of the two techniques. It is at this time that the D minor Invention, also in 3/8 meter, might have been played using the FW. The accentuation differences between the two D Inventions, the major in quaver pace, the minor in single-bar pace, may have helped to enlarge the perception of the effects of using a differentiated release of the key while keeping the same accentuation.

The expressive C minor Invention is one of the most challenging in terms of the use of the UW. Both the length of the combined subjects and the variety of the motifs and figures that make them up require a conscientiously nuanced approach to the attack and release of the key. The playing of trills on the fretted clavichord can be particularly problematic as a significant number of written-out ornaments call for the use of fretted keys. Practice has shown that these trills can easily be played when the fingers release the key at the right time. This does not affect the continuity of the ornament.

Having discussed a number of issues in relation to the physical aspect of the act of performance it is now necessary to briefly address the impact of the socio-cultural

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<sup>27</sup> See above, p. 159 and note 21.

sphere in the development of a techno-mechanical approach to the keyboard. In the next section of this chapter I will attempt to show that in Bach's particular case religion might have played a key role in this process as it seems to have significantly influenced his views on the aims of both vocal and instrumental music.

### **J.S. Bach's *cantabile* and the building of a techno-mechanical approach to the keyboard**

In his 1753 *Versuch über die wahre Art das Clavier zu spielen* Carl Philip Emanuel Bach indicates that a 'good performance' is denoted by the successful communication, by means of the voice or an instrument, of the true contents and affect of musical thoughts.<sup>28</sup> Following this idea he lists those aspects of performance necessary to attain this aim. However, he does not discuss in depth how the 'true contents' of a piece are to be identified.

As a number of other aspects related to the performance of music, the pupil was probably expected to absorb this information during the practical lesson. In other words, notions regarding music were to be acquired through the practice of the art. This practical attitude involved not only attaining an understanding of the contents of the music, but also the acquisition of a physical skill which would permit an interaction with an instrument. In this form, a meaningful aural image could be produced that would help to reveal these contents to the listener. The physical skill needed to handle an instrument was probably not viewed as a mechanism independent of the act of performance, however much some of our interpretations of the historical discussions on playing technique would suggest the opposite. This last idea might be of great relevance to the study of wear on historical keyboard instruments. Here and in the next chapter I will argue that a physico-mechanical skill developed under particular socio-cultural circumstances cannot be dissociated from the aims of music. Thus, these aims would need to be taken into account during an examination of the physical process that resulted in the appearance of the characteristic trace of wear present in some instruments. At this point it will be difficult to argue that this element of the performer's touch can be detected by an analysis of the physical trace left on the instrument. In spite of this situation, one

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<sup>28</sup> Bach, *Versuch*, Ch. 3, Performance, § 2. My translation.

would need to consider that it was present on the mechanical action of the performer. It was one which, in my opinion, helped to define, within a distinctive socio-cultural sphere, the meaningful character of a performance.

In the following discussion I use the word *cantabile*, in the title page of the AA, as the starting point for an exploration of the influence of an aspect of Bach's socio-cultural sphere—namely, religion—in the development of a techno-mechanical approach to the keyboard. I will suggest that Bach may have used this term to defend a view that the performance of instrumental music, as singing, helped to move listeners to devotion. The complex history of the Lutheran confession, to which Bach and his son Emanuel subscribed, shows us how Lutheran authorities resorted to music to help to defend and establish the precepts of the new confession while educating its members in the aspects of the Lutheran faith. Through this process singing was not solely to become a distinctive element of the confession, but also one which no one was to be able to dissociate from the idea of belief. Consequently, for some brands of Lutheranism music grew into an expression of devotion and worship.<sup>29</sup>

The term *cantabile* has been interpreted in various forms which can be sum up in the following categories:<sup>30</sup> 1) related to compositional technique (i.e. aiming at a balance of interest in all the parts in obbligato compositions)<sup>31</sup>; 2) related to vocal performance (i.e. that the lines are singable)<sup>32</sup>; 3) related to touch (i.e. denoting a

<sup>29</sup> For a brief summary of the role of music within the Lutheran faith, see appendix 4.

<sup>30</sup> For recent discussions on the interpretation of the term *cantabile*, see Ledbetter, *Bach's Well-Tempered Clavier: The 48 Preludes and Fugues*, 137–138, Simmonds, “Abstossen, Schleifen und Das Allgemeine Fortgehen,” 53–55; and John Butt, *Bach Interpretation: Articulation Marks in Primary Sources of J.S. Bach* (Cambridge: Cambridge University Press, 1990), 9–15. Badura-Skoda suggests that the “cantabile execution” Bach repeatedly demanded [...] means in the final analysis that in every melodic line there ought to be strong and weak and intense and relaxed notes [...] The clavichord and the fortepiano enable the performer to play in a direct and “natural” manner’. In Paul Badura-Skoda, *Interpreting Bach at the Keyboard*, trans. Alfred Clayton (Oxford: Clarendon Press, 1995), 168. For Philipp Spitta the word cantabile indicates a ‘flowing and expressive mode of execution’. See Philipp Spitta, *Johann Sebastian Bach: His Work and Influence on the Music of Germany, 1685-1750*, trans. Clara Bell and J.A. Fuller-Maitland, vol. 2 (London; New York: Novell & Co.; Dover Publications Inc., 1952), 55. For his part, Albert Schweitzer affirms that the cantabile style of playing applies only to the clavichord. He then proceeds to describe it in mechanical terms. See Albert Schweitzer, *J.S. Bach*, trans. Ernest Newman, vol. 1 (New York: Dover Publications, 1966), 207–208.

<sup>31</sup> E.g. Ledbetter, *Bach's Well-tempered Clavier: The 48 Preludes and Fugues*, 137–138.

<sup>32</sup> E.g. Johann Gottfried Walther, “Cantabile,” ed. Friederike Ramm, *Musicalisches Lexicon, Oder Musicalische Bibliothec (1732)* (Kassel: Bärenreiter-Verlag, 2001), 124 (1732: 134).

particular mechanical approach to the key).<sup>33</sup> Here I propose to take a different path which will require revisiting the term *cantabile* from a *devotional* point of view. In order to do this, it will be necessary to reflect on the issues that might have prompted Bach to use the term, namely, contemporary discussion on the possible ambiguous character of music, particularly in the cases when verbal text was absent; and the significance of the act of singing as an element of worship. Thus, in order to explore in a more systematic manner the potential religious significance of the term *cantabile*, I shall first introduce briefly some background on the origin of the AA's title page.

### **Bach, religion, and pedagogy**

As pointed out above, the *WTC*, the *OB*, and the *AA* are introduced by a title page whose carefully formulated texts speak of the pedagogical aims behind them.

Although the collections were compiled at different periods in Bach's life, their title pages appear to have been prepared around the same period.<sup>34</sup>

A number of phrases included in these title pages seem to point to a strongly religious-influenced perception of music. They hint at a conception of music in which both vocal and instrumental music were intended to worship God. However, more than one voice might have been raised to question the position of instrumental music within this perception.<sup>35</sup> Although instrumental music had been defended by

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<sup>33</sup> E.g. Schweitzer, *J.S. Bach*, 208. For a brief overview of a number of interpretations of the term, see Robert L. Marshall, "Johann Sebastian Bach," in *Eighteenth-century Keyboard Music*, ed. Robert L. Marshall (New York and London: Routledge, 2003), 99. Rudolf Steglich argues that the musical system in which Bach's *cantabile Art* is based is that of the 'well-regulated harmonic-melodic tension world of the major-minor tonal system'. See Rudolf Steglich, "Über Die 'Kantabile Art' Der Musik Johann Sebastian Bachs," in *Johann Sebastian Bach*, ed. Walter Blankenburg (Darmstadt: Wissenschaftliche Buchgesellschaft, 1970), 304–333, especially 313–314.

<sup>34</sup> See Wolff, *Johann Sebastian Bach*, 226–227. Teaching was an essential activity related to the post. See also Peter F. Williams, *The Organ Music of J.S. Bach* (Cambridge: Cambridge University Press, 2003), 227. It is important to recall that most of the pieces in the *OB* had been entered by 1717, well before the compilation of both the *WTC* and the *AA* took place (in Leipzig Bach entered in the *OB* two new works and revised two existing ones). Russell Stinson has suggested that the title page of the *OB* was prepared in Cöthen 'on behalf of his private pupils'. See Russell Stinson, *Bach: The Orgelbüchlein* (New York; Oxford: Oxford University Press, 1999), 24. This would suggest that this title page was probably written down before Bach even considered the possibility of leaving Cöthen. If this was the case, the other two title pages were probably devised resulting from its contents and style.

<sup>35</sup> For a number of theologians music should serve suitable texts. See John Butt, "Bach's Metaphysics of Music," in *The Cambridge Companion to Bach*, ed. John Butt (Cambridge: Cambridge University Press, 1997), 48; and Carl Dahlhaus, *Aesthetics of Music* (Cambridge: Cambridge University Press, 1982), 24–25.



musical authorities such as Seth Calvisius and Johann Mattheson,<sup>36</sup> the minutes of the meetings in which Bach was elected as St Thomas Cantor seem to confirm that, for a number of people, the line between devotional and theatrical music was not very clear.<sup>37</sup> As a result of this, Bach might have had concerns regarding the reception of the *WTC* in Leipzig. For this reason he may have felt compelled to put an emphasis on the soundness of his pedagogical approach (or was urged to do so).<sup>38</sup> Bach was to do this, I suggest, by relying on the established perception of the act of singing as an essential pedagogical tool and component of religious life. Thus, the term *cantable* in the title page of the *AA*—the word written in large letters—was probably intended to be read as an expression of his belief that his instrumental music collections, in their origin and ultimate place of influence, were firmly situated within the sphere of worship. In this respect the instruction on performance was to play a fundamental role in the ability of the pupil to play non-verbal music on the keyboard with the proper intention, namely, worshipping God and helping to move listeners into devotion.

An examination of the particular instance in which the term *cantable* appears seems to support the hypothesis presented above. The 1723 *AA*'s title page,<sup>39</sup> in contrast with the title pages of the *WTC* and the *OB*, provides a large amount of information on instruction. The lovers of the clavier and those desirous of learning will thus be shown

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<sup>36</sup> Ibid. 24–25.

<sup>37</sup> For a detailed analysis of the minutes, see Siegele, “Bach’s Situation,” 146–149.

<sup>38</sup> Peter Williams asks: ‘Was this book [...] something prepared for publication?’ See Peter F. Williams, *The Life of Bach* (Cambridge: Cambridge University Press, 2004), 89. Bach might have considered the publication of the work although probably not at that point. The possibility seems also remote considering the length of the *WTC*, and its rarity as a collection: ‘[...] one easily forgets how strange it is’. Ibid. 170. See also above, note 21.

<sup>39</sup> See Wolff, *Johann Sebastian Bach*, 226. The title has been translated in different forms, e.g. *Honest method*, Johann Sebastian Bach, “Inventionen Und Sinfonien,” ed. Rudolf Steglich (München: G. Henle Verlag, 1970), IV, 1970; *Sincere Instruction*, Richard Douglas Jones, “Inventions and Sinfonias,” ed. Malcolm Boyd and John Butt, *Oxford Composer Companions: J.S. Bach* (Oxford: Oxford University Press, 1999), 241; *Candid Instruction*, David Schulenberg, *The Keyboard Music of J.S. Bach* (New York: Routledge, 2006), 186; *Sincere Guide*, Stephen Daw, “Bach as Teacher and Model,” in *The Cambridge Companion to Bach*, ed. John Butt (Cambridge: Cambridge University Press, 1997), 198; *Upright Instruction*, David, Mendel, and Wolff, *NBR*, no. 92, 97–98. Bach might have been influenced by Luther’s use of the term *auffrichten* which is found in the title of his pamphlet *An die Radherrn aller stedte deutsches lands: das sie Christliche schulen auffrichten vnd hallten sollen* (1524). In this instance the term refers to the foundation of schools (*schulen auffrichten*). Bach’s use of the adjective *Auffrichtige* might then be understood as a reference to an intention to instruct beginners in the foundational elements of keyboard playing.

[...] eine deutliche Art gezeigt wird, nicht alleine (I) mit 2 Stimmen reine spielen zu lernen, sondern auch bey weiteren progressen (2) mit dreyen obligaten Partien richtig und wohl zu verfahren, anbey auch zugleich gute inventiones nicht alleine zu bekommen, sondern auch selbige wohl durchzuführen, am allermeisten aber eine cantable Art im Spielen zu erlangen, und darneben einen starcken Vorschmack von der Composition zu überkommen

[...] a clear way not alone (1) to learn to play clearly in two voices but also, after further progress, (2) to deal correctly and well with three *obbligato* parts; furthermore, at the same time not alone to have good *inventiones* but to develop the same well and, above all, to arrive at a *cantable* style in playing and at the same time to acquire a strong foretaste of composition.<sup>40</sup>

In the above-quoted text of the AA's title page one can identify two main sections: the first includes information on technical aspects concerning physical performance (e.g. clear and correct playing in two and three voices), and the pursuit of good musical ideas and their proper development; the second, clearly indicated through the use of the phrase 'above all', points to the fundamental aim of the collection, namely, gaining an awareness of the manner of performance while acquiring 'a strong foretaste of composition'. The pivotal phrase not only helps to distinguish Bach's pedagogical practice components. It also emphasises Bach's Lutheran beliefs in relation to music at a very distinctive level: music is to serve and praise God, and move men into devotion.<sup>41</sup> Bach had already expressed his views on the aims of music, though paraphrasing F. E. Niedt, by stating in his definition of thorough-bass that '[...] the ultimate end or final goal of *all music* [...] shall be nothing but for the honour of God and the renewal of the soul'.<sup>42</sup> When the word *cantable* is read through the lens of this conception it appears to indicate that the music in the collection is to be performed in a manner that would pursue the aims of singing within the liturgy and daily life.

<sup>40</sup> Ibid. no. 92, 97–98.

<sup>41</sup> '[U]se the gift of music to praise God and Him alone, since He has given us this gift'. In Luther's preface to *Harmonias de Passione Christi* (1538); quoted in Walther E. Buszin, "Luther on Music," *Music Quarterly* 32, no. 1 (1946): 82.

<sup>42</sup> Bach's definition is contained in the second chapter of his *Elementary Instruction in General-Bass* (1738). See Pamela Lee Poulin, ed., *J.S. Bach's Precepts and Principles for Playing the Thorough-Bass or Accompanying in Four Parts: Leipzig, 1738* (Oxford: Clarendon Press, 1994), 10–11. See also Butt, *Music Education*, 39–40. The emphasis is mine. Bach's request to Kirnberger to transplant what he had learnt from him 'in the minds of other good students who are not satisfied with the ordinary *lirum-larum*' might also have to do with his concern over contemporary conceptions of music. For Bach's remark, see David, Mendel, and Wolff, *NBR*, no. 316, 322–323.

### **[...] am allermeisten aber eine cantable Art im Spielen zu erlangen**

When considering the word *cantable* in the manner above proposed one could suggest that for a number of musicians an instruction in instrumental performance might have been derived from the experience gained through singing.<sup>43</sup> Thus, chorale melodies, carefully interspersed throughout the daily routine, may have been the ones that helped to strengthen the idea that a solid link between singing and instrumental music existed. It is already well known that chorales were used in the instruction of thorough bass.<sup>44</sup> But chorales were also present in the initial stages of keyboard instruction. For instance, in 1697 Daniel Speer emphasised that the study of ‘all worthy matters and good free arts should begin with God and respectability’. For this reason, chorale melodies should be given preference to ‘*Balleten, Couranten, Arien, Sarabanden*, and other dances’ when instructing beginners. Speer makes it clear that there is also a practical advantage to the use of these melodies: since chorale melodies are also known to those around the pupil, that is, family and friends, they could sing while the pupil practices them on the instrument.<sup>45</sup>

It is then through the practice of chorales in an instrumental medium that the subjective association between religion and music was probably to be extended to this field of music performance. The practice of these simple *exercitia*—or, using a term that Bach might have associated to devotional playing, *Übungen*—may have helped the pupil to become attuned to the religious implications of instrumental music-making. As a result of this process a mechanical-aural association may have taken place which was to give origin to a specific techno-mechanical approach to the keyboard. This approach was probably to allow a performer, within particular Lutheran socio-cultural realities, to play in a manner that would move the player

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<sup>43</sup> As Leszek Kołakowski has pointed out, ‘whatever people say in religious terms is understandable only by reference to the entire network of signs of the Sacred’. See Leszek Kołakowski, *Religion: If There Is No God*, 2nd ed. (London: Fontana Press, 1993), 168.

<sup>44</sup> See, for instance, Emanuel Bach’s thoughts on this matter in David, Mendel, and Wolff, *NBR*, no. 395, 399. See also Daniel Speer, *Grund-Richtiger, Kurz-Leicht Und Nöthiger, Jezt Wohl-Vermehrter Unterricht Der Musicalischen Kunst, Oder Vierfaches Musicalisches Kleeblatt* (Ulm: Georg Wilhelm Kühnen, 1697), 46–47.

<sup>45</sup> All quoted passages are from *ibid.* 46. The translations are mine.

himself and his listeners to devotion. In this form the notion of instrumental performance as a devotional act would have probably been consolidated.<sup>46</sup>

As will be discussed in the following chapter, the instrument, as cultural object, cannot be dissociated, just as physical space, song, and daily life, from Bach's Lutheran socio-cultural sphere. There I will also argue that, as a result of both our body's detachment from particular historical socio-cultural spheres and the absence of the historical body of the performer, we need to resort to the evidence offered by the historical musical instrument.

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<sup>46</sup> This notion seems to have been reinforced by the stress given by some authors to the devotional character of their keyboard music collections. Daniel Vetter, for instance, clearly indicates in the title of his 1709 collection *Musicalische Kirch- und Haus Ergötzlichkeit* that the music contained in the volume is for 'refreshment' (*Ergötzlichkeit*). However, he later emphasises that this refreshment 'is far nobler when it is based on spiritual exercise' (*so weit edler ist dieselbige sonder zweiffel zu schätzen / wenn sie eine geistliche Übung zum Grunde hat*). See Stephen Rose, "Daniel Vetter and the Domestic Keyboard Chorale in Bach's Leipzig," *Early Music* 33, no. 1 (2005): 49–50. The fact that Vetter observes that the music of his collection can be performed on the organ as well as on *Spinetten* and *Clavichordien* suggests the performance of music at home was seen as a form of private devotion.

## 5 The clavichord as a cultural object: reading history through the lens of the musical instrument

In previous chapters I have argued that an investigation into the processes behind the shaping of the performer's techno-mechanical approach to the keyboard, an amalgam of socio-cultural and physico-mechanical components, is necessary if a broader understanding of its effect in the cultural impact of a performance is to be achieved. Although this approach—which in combination with the always changing body gives origin to an individual bodily attitude at the instrument—appears to be largely defined by the socio-cultural reality within which a particular art of performance exists, an analysis of some of its physico-mechanical components in isolation had to be attempted. This was necessary in order to identify and shed some light upon the possible impact on the musical outcome of some fundamentally biomechanical and organological aspects involved in keyboard playing; their importance rests on the fact that these characterise the physical relation between the performer and her instrument. In this chapter I will carry on with this exploration while adding to the discussion the potential information concerning the performer's bodily attitude that an analysis of some issues related to the historical musical instrument appears to provide.

The musical instrument—as the human body, '[t]he very first of all'<sup>1</sup>—is a cultural object; as such, it bears witness to a socio-cultural need. But the instrument is also a cultural vessel in which the mechanical actions of the historical body accumulate in various possible forms. In particular, it is during its use in the practice and performance of music that physical evidence in the form of wear accumulates on its surfaces. This evidence, which is particularly evident above the key tops, is the product of the physical interaction between the performer's body and the instrument.

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<sup>1</sup> Maurice Merleau-Ponty, *Phenomenology of Perception* (Oxon; New York: Routledge, 2002), 406.

The evidence of wear cannot be solely ascribed to the effect of the mechanical aspects of playing. This since, as I have already discussed in chapter 2, physical action is nuanced by, and responds to the influence of, socio-cultural realities. This is to say that, while it is clear that this physical evidence is necessarily the result of a mechanical process, techno-mechanical aspects of performance have to be seen as exercised by performers whose bodies, as well as musical instruments, have been shaped within a socio-cultural reality. For this reason it will be also necessary to define the place of the musical instrument within a cultural sphere.

Some significant problems that a study of wear introduces have to do with the question of how the physical evidence came into existence, and if the process behind its production can be sufficiently understood based only on an analysis of the worn-out instrument. A lack of precise information regarding the first point is behind the analysis, in chapters 2, 3 and 4, of the physicality of some historical physico-mechanical approaches. The outcome of this analysis has helped to define in a more detailed form the mechanics involved in a number of approaches to the keyboard. The information presented there will then help to understand the possible impact of the physical body and its action on the instrument by relating a mechanical movement to the appearance of wear evidence. In order to do this, experimental confirmation which could more readily illustrate how the trace of wear came into existence is vital. For this reason an experimental instrument had to be built. This has helped to reveal more rapidly the process through which the physical trace came into existence. A well-defined technique had to be applied to this instrument so that a large number of mechanical movements would be known in advance, and their relation to a wear trace could be stated more clearly. The approach used on the experimental keyboard was that determined in the reconstruction of Bach's technique, whose basic aspects were discussed in chapters 3 and 4.<sup>2</sup> It is expected then that once the information derived from the experimental clavichord is analysed side by side with the evidence present on historical instruments a better understanding of the approaches used on particular instruments will emerge.

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<sup>2</sup> See above, pp. 139 ff.

It is hoped that the information derived from this study, when jointly reviewed with that coming from an inquiry into the socio-cultural component of the performer-instrument relation, will help in an attempt to broaden our appreciation of how physico-mechanical approaches operated within particular cultural settings. These approaches certainly produced contrasting musical outcomes from one performer and society to another. The historical instrument might thus help us, to a certain extent, to nuance our understanding of the reasons behind the shaping of a techno-mechanical approach.

### **The impact of new technologies**

In 1882 the German composer and writer Heinrich Köselitz wrote to Friedrich Nietzsche: ‘my thoughts in music and language often depend on the quality of pen and paper’. In his subsequent letter to Köselitz, Nietzsche reacted to this idea by commenting: ‘you are right [...] our writing implement contributes to our thoughts’.<sup>3</sup> The implications of Nietzsche’s answer can only be fully appreciated when one considers the context surrounding Köselitz’s observation. Köselitz’s idea emerges as a response to Nietzsche’s most recent writings which had been produced, just as his above quoted answer, in a novel invention: the Hansen writing ball, the first typewriter produced in series. Nietzsche had decided to obtain one of these devices, developed by the Danish inventor Rasmus Malling-Hansen, as a result of his eyesight problems and his awareness of the high touch-typing speed which a trained typist could reach. Although he applied himself to learning how to write on this machine, and was to produce some work on it, Nietzsche might have not had the opportunity to attain a high typing speed. This was largely due to the device’s mechanical problems derived from the damage inflicted to the typewriter during its transportation from Copenhagen to Genoa, where Nietzsche was residing at the time. As a result of this deficiency his mechanical writing had been slowed down,

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<sup>3</sup> The text written by Nietzsche reads (in capital letters): ‘SIE HABEN RECHT - UNSER SCHREIBZEUG ARBEITET MIT AN UNSEREN GED<A>\MKEN’. In a letter to Köselitz. Quoted in Christof Windgätter, “Rauschen. Nietzsche Und Die Materialitäten Der Schrift,” ed. Günter Abel, Josef Simon, and Werner Stegmaier, *Nietzsche-Studien* 33 (2004): 22.

something which might have had a significant impact on the linguistic presentation of his typed texts.<sup>4</sup>

The effect of the typewriter on Nietzsche's writings allows us to get a glimpse of the impact the introduction of a different or new technology can have on the outcome of activities involving long established practices such as writing. The effects of this introduction are, however, often not immediately perceived by those who adopt the technology—just as in the case of Nietzsche, who appears to have been initially unaware of the effect the use of the machine was having in his writings. Although at some point after the adoption of the tool some of the potential practical advantages and disadvantages related to its continuous use may become evident (e.g. experienced typists will write much faster than a person using pen and paper; on the other hand, the evidence of a person's calligraphy will be forever lost), in some cases the identification of the long-term effects the use of the tool might entail can prove more complex. At the same time, the presence of immediately available benefits can potentially conceal alterations or distortions of previously expected effects of some purposely construed actions, ideas, gestures or mechanisms. Moreover, in the long term the tool could also help to reshape the views of the process in which the instrument participates, and experience an alteration in its building characteristics as a result of the impact of its agency on the socio-cultural sphere within which it operates.

### **The clavichord as an intellectual technology**

With the reintroduction of the keyboard during the medieval period the organ called for the development of a new form of playing. Iconographical evidence suggests that before the keyboard was used the most common mechanism used to play the instrument consisted of a series of perforated sliders which required a pulling-pushing movement from the performer.<sup>5</sup> The initial presence of the keyboard on the medieval organ—in probably a large variety of designs as this new organological

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<sup>4</sup> For a discussion on the impact of the typewriter on Nietzsche's work, see Christian Emden, *Nietzsche on Language, Consciousness, and the Body* (Urbana: University of Illinois Press, 2005), 27–31.

<sup>5</sup> This can clearly be seen in depictions of the organ found in the *Pommersfelden Psalter* and the *Harding Bible*. See Perrot, *The Organ*, 280–281, and plate XXV 1 and 2.



element might have been interpreted and adapted by builders in different forms—might have then sparked the flowering of multifarious playing approaches. For some particular reasons (which will need to be examined in another study), some of these approaches were to prevail and remain in the practice of a number of players. At the same time, both the existence of the organ in a diversity of sizes and shapes and its presence within dissimilar performance circumstances were certainly to have a gradual effect on the manner in which some of these approaches continued to be used, and were later adapted, modified, or replaced altogether.

Early ways of handling the organ by means of its keyboard were in part the result of an instrument and its performer being immersed within unique, and always changing, societies and musical cultures. Thus, the techno-mechanical approach to the instrument was in part a result of the player's exposure to characteristic keyboard organologies and a variety of instrumental resources, and his collected experiences in performances within always-changing physical conditions and socio-cultural realities.<sup>6</sup> A modification of any of the components of this system might have obliged performers to adopt idiosyncratic approaches to the instrument. With the introduction of the clavichord within the professional life of the organist bodily attitudes were again reshaped. But, in this case, the long-term impact seems to have been of a different kind as a result of how the clavichord was perhaps to be used in the secular world.

Considering the limited information available regarding the historical appearance of the clavichord, the organist's first impressions, opinions, and the ways in which he or she might at first have handled the instrument can perhaps not be grasped with any degree of certainty. Any inquiry into these issues is further complicated by the fragmentary condition of the information available concerning the organological detail these professionals might have initially encountered on the various manifestations of the instrument. The relevance of this consideration is high: a knowledge of the organological characteristics that made the clavichord attractive to the organist to play on it—and thus to be used beyond theoretical demonstration and the teaching of pitch to singers—might help to establish the impact of its use on

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<sup>6</sup> On these issues, see above, chapters 1 and 2.

some of the technical and mechanical aspects related to the playing and building of the organ, and the other way around. As it is, one can perhaps only speculate about these organological characteristics, as well as the reasons behind the particular direction the development of these instruments' organology was to take once the clavichord found the organist's favour.<sup>7</sup>

As a new technology of the intellect (i.e. as a novel means of (musical) communication)<sup>8</sup> the clavichord might have begun to exercise a solid and lasting influence over the organist's views on performance from the historical moment in which it entered the sphere of *musica practica*.<sup>9</sup> This recently-gained place, however, seems not to have led to a state of affairs in which the clavichord was to be considered as an autonomous musical instrument. This is to say that, rather than having immediately gained a performance-instrument status the clavichord seems to have been initially perceived as a stand-in instrument where the organist could practice and teach. Consequently, even if the clavichord was to physically replace the organ during these instances it is likely that the instrument was to be handled in the same way as the church's instrument was.<sup>10</sup>

The use of a different musical instrument—though a keyboard one—was to give rise to a process of abstraction of the techno-mechanical components of organ playing, a process which was to have an impact on the techno-mechanical relationship between the performer and the organ. This process was set in motion as a consequence of the modification of the organological, aural and spatial circumstances of organ playing.<sup>11</sup> In other words, the use in a different keyboard

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<sup>7</sup> For a discussion of the relation of the clavichord to the organ, see above, chapter 2, pp. 49 ff. Some of the effects the use of the clavichord might have had on the organ's organology (and the other way around) have been advanced in chapter 1.

<sup>8</sup> Throughout this discussion I use the term 'technology of the intellect' with which the social anthropologist Jack Goody refers to the means of communication of a society. See Jack Goody, *The Domestication of the Savage Mind* (Cambridge: Cambridge University Press, 1977), 10; and Jack Goody, *The Interface Between the Written and the Oral* (Cambridge: Cambridge University Press, 1987), 59.

<sup>9</sup> The clavichord might hitherto have been used as a theoretical demonstration instrument next to, or having even entirely replaced, the monochord. See Joseph Smits van Waesberghe, *Musikerziehung: Lehre Und Theorie Der Musik Im Mittelalter* (Leipzig: VEB Deutscher Verlag für Musik, 1969), 164–165.

<sup>10</sup> See above, chapter 2, pp. 49 ff.

<sup>11</sup> For Goody, writing is a major force behind the transformation of speech since it permits the abstraction of its components. See Goody, *The Domestication of the Savage Mind*, 128.

instrument of the skills attained originally at the organ was to expose performers to an altered musical outcome as these skills operated removed from the instrumental reality in which they had been acquired. A growing awareness of the dissimilar aural outcome, as well as of its effect on the music and the listener—compared to those available when performing at the organ—was probably to lead to a reassessment of the physical handling of the organ.

As suggested above, the organ's hierarchy as the performance instrument might at first have led performers to ignore the clavichord as a performance vehicle. As a consequence of this situation a conscious disregard of any particular new aural experiences gained at it might have existed, however much some of the techno-mechanical elements of keyboard playing may have been altered throughout this process. At some point, however, historical documents begin to show the clavichord's influence on performers. But while in some instances the instrument is not even mentioned—though its influence in the physico-mechanical directions can be sensed—in others the instrument is considered an essential part of the organist's training.<sup>12</sup> The two following examples might serve to illustrate this situation:

1) In chapter XV (*On striking the keys*) of his treatise *Arte de tañer fantasia*, Tomás de Santa María describes a few crucial aspects of the manner in which the performer should approach the keyboard of an instrument. It is in the second point of the third requirement that he informs us that '[one should] strike the keys strongly and with good attack, which is otherwise called playing firmly, and then the tone is full-bodied and bright'.<sup>13</sup> However, in the fifth and sixth points the following advice is to be found:

The fifth point is to depress the keys as far as they will reasonably go, so that if the instrument is a clavichord (*monacordio*), the tangents should lift the strings but not so much as to make the note sharp, which is caused by pressing too hard with the fingers. On any other instrument the keys should be depressed until they

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<sup>12</sup> In his *Liber viginti atrium* (c.1460), Paulus Paulirinus refers to the clavichord as an excellent instrument where to prepare for the study of organ performance. For the Latin text, see Brauchli, *The Clavichord*, 304, note 33. An absence of records seems to confirm that the organ was not used beyond the purposes of acoustic tryouts and performances. This would have helped to both reduce the costs involved in the necessary pumping of the bellows and to avoid the low temperatures of an unheated church. See Rampe, "Sozialgeschichte Und Funktion," 87.

<sup>13</sup> Santa María, *Arte*, f. 37 v.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 10.

touch the cloth (*pañó*) below them. That is, of course, always assuming that the keys can reach the cloth.

The sixth point is that once the keys have been struck do not lean on them with the fingers (because, apart from sharpening the notes and making them out of tune, the hands are weakened as if they are tied) and do not relax the fingers so that the notes die away, but keep the fingers on the keys without pressing too much nor relaxing nor raising them until they are needed to strike other keys. In this way the notes will retain their fullness of tone.<sup>14</sup>

Santa María's focus on the clavichord's physico-mechanical requirements not only reveals his practical understanding of the instrument's key touch features.<sup>15</sup> As I will suggest below, it also explicitly points to the impact in organ performance of the 'growth of knowledge' occurring within the sphere of keyboard playing as a consequence of the use of the clavichord.

2) In the rules for playing the organ contained in *Il Transilvano*, Girolamo Diruta indicates that the keys of the organ should be pressed rather than, as when playing

<sup>14</sup> Santa María, *Arte*, f. 38 r.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 11.

<sup>15</sup> This particular observation bears witness to the prominent influence the clavichord's touch had come to exercise on the player's approach to the organ. However, given the antecedents of the relation between the clavichord and the organ it would be too simple to say that Santa María's treatise is a publication primarily concerned with the clavichord, as considered by some authors (Brauchli, *The Clavichord*, 255; and Maurice Esses, *Dance and Instrumental Diferencias in Spain During the 17th and Early 18th Centuries: History and Background, Music and Dance*, vol. I (Stuyvesant, NY: Pendragon Press, 1992), 240). Santa María is indeed of the opinion that 'it is impossible to be a consummate player without first having full knowledge and true understanding of the playing of the clavichord' (Santa María, *Arte*, f. 12 r.; Esses, *Dance and Instrumental Diferencias in Spain*, 240). However, the fact that within the general discussion on keyboard playing those issues related to specific aspects of clavichord playing are clearly indicated as such suggests the existence of another balance between the organ and the clavichord in this work. For instance, Santa María asks his readers to 'depress the keys as far as these will reasonably go, so that if the instrument [in which one is playing] is a clavichord [*monacordio*], the tangents should lift the strings but not so much as to make the note sharp [...]' (Santa María, *Arte*, f. 38 r.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 11). Such wording seems to indicate that Santa María considered those observations in which no instrument is named as relevant to the organ as to any other keyboard instrument. An exception, however, is found in chapter XV (Santa María, *Arte*, f. 37 v.–38r.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 10) where he recommends 'to strike the keys equally, that is, one hand should not play more loudly nor more softly than the other [...]', something which would be certainly advisable to the player of the clavichord. In my opinion, in this case Santa María omits to mention a particular instrument as he might have expected that both the organ and the clavichord were to be played using a similar touch. In consequence, an observation made for one instrument would be valid for the other. In all, though the clavichord seems to occupy a more prominent place within the discourse of this treatise, Santa María's attention to it is probably only an indication of the considerable importance the instrument already had as a means for the practice of performance (but see below the case of Bernardo Clavijo's examination). It would thus be too far to suggest that the treatise gravitates exclusively around it.

dances on quilled instruments, struck.<sup>16</sup> Although the clavichord is not mentioned throughout the treatise it would be difficult to argue that this instrument was not to be easily found in the Italian organist's studio, particularly given the historical evidence of its presence at the time in the peninsula. Seen from this perspective, Diruta's organ-touch preference seems to clearly speak of an acquaintance with the touch boundaries of the clavichord (i.e. those which Santa María so readily stated in his own book). At the same time, it appears to give an inkling of the presence of the clavichord in the professional life of the Italian organist.

Diruta's failure to mention the instrument might have to do with a more conservative view of the place the clavichord should occupy in the organist's life. That is to say, he might have regarded it as a practice and teaching tool rather than a vehicle for performance. In this sense, it is interesting to see that around the same period the instrument seems to have been gaining in Spain a more prominent place as a performance instrument. This is illustrated by the case of the Spanish organist Bernardo Clavijo. When examined in 1593 for the post of chair of music at the University of Salamanca, Clavijo was required to perform on the clavichord rather than on the organ, an event which suggests that the instrument was already considered as a suitable performance vehicle.<sup>17</sup>

A gradual awareness of the clavichord's sound qualities, an ability to control them by means of touch, and the consciousness of their effect on a listener might have led performers of various latitudes to re-explore the available aural expressive resources of the organ. However, this move was probably not to alter prevalent views on the clavichord's hierarchy in an immediate and significant form. Although this instrument already began to represent a new means of musical communication, it is only at a much later time that the clavichord was to be recognized, exploited and appreciated as an independent medium for performance.

The embracing of particular mechanical approaches to the keyboard, such as the high-wrist position, appear to speak, as has been pointed above in chapter 2, of a

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<sup>16</sup> Carol MacClintock, *Readings in the History of Music in Performance*, 1. Midland ed. (Bloomington & Indianapolis: Indiana University Press, 1982), 91.

<sup>17</sup> See Beryl Kenyon de Pascual, "Clavicordios and Clavichords in 16th-Century Spain," *Early Music* 20, no. 4 (1992), 616.

performer's response to, for example, the playing of the clavichord under various spatial circumstances. However, it is important not to lose from sight that the use of both a new technology of the intellect, and the specific techno-mechanical approaches this technology helped to introduce, signals important changes in the musician's modes of thought.<sup>18</sup> There is thus a "'growth of knowledge'" which 'presupposes certain processes which are related [...] to the modes of communication by which man interacts with man and, more especially, transmits his culture, his learned behaviour, from generation to generation'.<sup>19</sup> These approaches, on the one hand, were to alter man's perception of a musical reality and, on the other, helped to unveil, through the techno-mechanical changes the clavichord helped to introduce, means of performance which exercised an 'interior [transformation] of consciousness'.<sup>20</sup> Music composition and performance were probably to be affected in a similar form.

Within Lutheran society, the strong link between music and religion was to define the manner in which the clavichord was to be approached. The presence of the instrument in schools and homes speaks for the role the instrument was to play, namely, to help to strengthen belief and move people to devotion. This association was to have another effect: it was to contribute to the ubiquitous presence of music in society, leading perhaps to a view among people that the space where instrumental music was performed was a worshipping place.<sup>21</sup> The probable intimacy resulting from this introspective playing was perhaps to contribute to a change in the form music was experienced and, consequently, composed and performed.<sup>22</sup>

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<sup>18</sup> Goody defines these as 'the formal, cognitive and linguistic operations [...] of an individual. Here I closely follow Goody's argument on the impact the introduction of the written list had on the modes of thought. See Goody, *The Domestication of the Savage Mind*, 80–84, especially 81.

<sup>19</sup> Ibid. 37.

<sup>20</sup> 'Technologies are not mere exterior aids but also interior transformations of consciousness'. Walter J. Ong, *Orality and Literacy: The Technologizing of the Word, New Accents* (London; New York: Routledge, 1982), 82.

<sup>21</sup> The ubiquitous presence of devotional singing in Lutheran society might have contributed to a perception that devotional practices could take place wherever singing was present. See also above, chapter 4, note 46.

<sup>22</sup> The musical instrument is a cultural object which can help to throw light upon how music was heard, composed and performed within distinctive historical socio-cultural realities. An understanding of how it was to influence, and was influenced by, its socio-cultural surroundings can perhaps help to widen our understanding of historical performance practices and the way in which people of the past, as well as us, experienced music. For an discussion on these issues, and particularly the implications

A gradual awareness of the clavichord's expressive qualities might have contributed to the shaping of the relation between keyboard playing and singing. At the turn of the sixteenth century, keyboard music began to acquire an individual character as a result of the exploration of the keyboard medium and its resources, something which might have been facilitated by the right-at-hand presence of the clavichord. Although this instrument was only to be gradually considered a performance instrument, its constant presence was probably to be determinant in the path both keyboard music and performance were to take. In this respect, it is possible that an idea that one could sing through the instrument, perhaps nourished by the instrument's expressive resources, increasingly available through the playing of the clavichord, was to drive some to consider it as a place to practise performance. Moreover, the character of the expression in playing attained on it was perhaps to take the clavichord to be considered as a devotional medium. One could sing, at home, through an instrument.

In all, the clavichord as the intellectual technology it is could give an inkling of the socio-cultural reality in which it existed. As a cultural object the historical clavichord represents an invaluable source of information which might help us to understand the origin and implications of the musician's historical modes of thought. Part of the information that an instrument might be able to provide is related to the performer's activity at it. This activity has left physical traces. The wear on the surface of the keys produced by the action of the body, in particular the contact with the fingers, over the keys, is, as I will argue, of great value to performance studies.

## **Wear**

The physical evidence of wear present on the surface of the keys of historical, and non-historical, instruments is probably one of the few material traces that attest to the interaction of the performer with the musical instrument. It is also one that, as far as I know, has not been studied in depth. For this reason it will be first necessary to

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of intention in performance, see John Butt, "Historical Instruments and the Embodiment of Music," in *Musique Ancienne - Instruments Et Imagination / Music of the Past - Instruments And Imagination: Actes Des Rencontres Internationales Harmoniques 2004/ Proceedings of the "Harmoniques" International Congress 2004*, ed. Michael Latham (Bern: Peter Lang, 2006), 9–16.

introduce and briefly discuss some relevant issues related to the circumstances and processes connected with the appearance of this material trace.

The pre-eminent reason behind the appearance of wear is mechanical. Yet, it is important to emphasise that the body responsible for its production is one that has been shaped by, and existed within, a particular socio-cultural sphere. Thus, the initial mechanical analysis of wear is meant to serve as a middle step in the understanding of the socio-cultural body behind the physical trace. It is expected that the subsequent analysis of the evidence present in historical instruments—aided by the information provided by an experimental clavichord—will offer valuable information which will help to shed some new light upon particular issues related to historical aspects of performance.

Daily activities often entail an interaction with objects performing distinctive functions: one opens doors with the aid of a handle, or by pushing it; mugs are held by their handle; towels are used to dry our hands. Sometimes—as in the case of shoes, clothes and watches—the object remains attached to our bodies throughout the day. In the particular case of shoes, this situation causes shoe soles to interact physically, and in a continuous form, with a diverse variety of surfaces. The effect of this situation is easily recognized in the rapid and distinctive change of the sole's original condition.

The element with which the shoe sole is most often in contact is the floor; although usually constituted of, or manufactured with, materials far harder or wear resistant than those of the shoe soles the floor's original appearance could change dramatically. This is partly as a result of it being constantly subjected to the coming and going of hundreds of feet, not to speak of the action of other mechanical forces or chemical elements. The effect of all these agents on the floor's physical appearance will often become apparent only after a prolonged time span. A clear example of this situation is shown in the form of a track in the woods (see plate 5.1).





**Plate 5.1 A path in the forest**

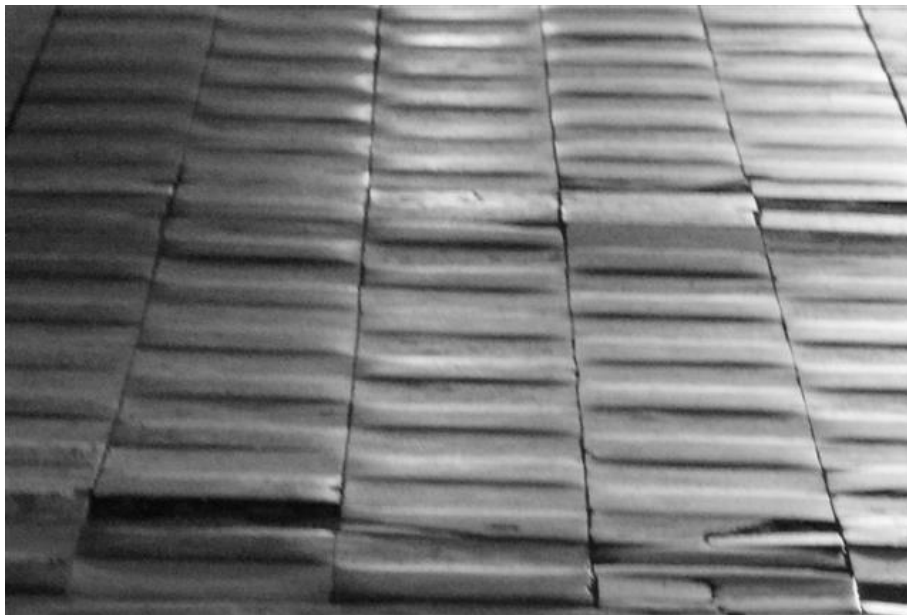
Needless to say, various factors and processes would need to be considered when trying to understand the transformation undergone by the once virgin piece of land pictured above. Rain, wind,<sup>23</sup> vegetation growth and decay are, next to the particular action of the hikers' feet, among those elements behind the modification of the original condition of the floor. Furthermore, the interaction between the floor and the shoe sole, as well as its resulting effect on each other, will vary depending on the condition of the floor and the sole at any given time; this condition will result from the combination and balance of the various elements affecting the floor and the sole. For example a wet floor will suffer of more material removal than a dry one; a leafy path will protect the floor not only from the action of the feet but also from that of erosion. On the other hand, the mechanical interaction between the sole and the floor

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<sup>23</sup> In other words, erosion plays also a large role in the path's change of appearance.

will be affected by the characteristics of the sole, and the weight and the particular physical and biomechanical characteristics of the hiker's feet.

The effect of footwear in an urban context is at times quite evident. For instance, the stone-tiled floor shown in figure 5.2 is of particular interest. The distinctive wear patterns that can be observed on this surface can be initially ascribed to the different mechanical properties of the materials from which the tiles are made. One of these, clearly harder than the other, has better resisted the action of the pedestrian's feet allowing less wear to become visible after decades of continuous use.



**Plate 5.2 Floor in Lisbon with different material tiles**

A few aspects deserve some comment. First, as has been said, the tiles have a contrasting resistance to wear. In the image two distinctive groups of tiles can be identified, one of whose surface level is clearly below that of the other. The reason behind this situation is that the wear coefficients of each of them are significantly different.<sup>24</sup> In other words, the high profiled tile is constituted of a harder material—which resists better the material loss resulting from the tile's 'interaction [...] with its interfacing environment'—than that of the lower level one.<sup>25</sup> Since it is quite

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<sup>24</sup> For a technical discussion of wear and the determination of the wear coefficient see Ramnarayan Chattopadhyay, *Surface Wear: Analysis, Treatment and Prevention* (Materials Park: ASM international, 2001), 57–62, especially 59–61.

<sup>25</sup> Ibid. 57.

probable that both groups of tiles shared the same surface level when the floor was originally laid, both would then have been subjected to a similar action of the pedestrian shoes. This would mean that in the same time span the two groups of tiles have manifested a different amount of wear as a result of the difference in their physical resistance to mechanical action.

Second, though it is obvious that the condition of the tiles will change after the initial contact with the pedestrians' feet, and that the wear rate will in most cases remain constant, a worn out tile will wear differently as time passes by. This is to say that the original surface of the tile will suffer only one contact in this original surface; further contacts of the shoe soles with the tile will occur in a surface already modified by a previous contact.<sup>26</sup> Although the effects of this process might not be immediately apparent these will, after some time, become evident in the form of a change of shape and thickness of the original tile.

Third, one of the long term consequences of the wear process described above is that a modified plate, which will present a different shape and floor level after every new contact, will gradually affect the action of the feet. This is particularly clear in some specific cases. Let us consider once more the floor in plate 2. Experience will tell us that to walk on the pictured surface will not be the same as to do it on an evenly levelled one. Thus, walking, as well as its effect on the floor, also becomes uneven. The worn-out edges of the high-coefficient-rate tiles are a clear symptom of this situation. That is to say, one of the consequences of the growth in the level difference between the tiles is that the single-level contact area between the foot and the floor will gradually decrease. Generally speaking, since the foot would initially come into contact with the highest level area of the floor the protuberant tile will receive the action of the foot first. In this case, and since the protuberant tiles will now offer around 50 per cent of the original same-level contact area, the contact area offered by the high-level tile might not be sufficiently large to support the foot's force—normally unconstrainedly exerted as the body would be expecting to encounter a same-level surface. As a consequence of this situation, excessive force

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<sup>26</sup> In many instances one will be speaking of microscopic changes. However, though these might be invisible to the naked eye, it is evident that the worn-out condition of the tiles is a consequence of the sum of each and all of these contacts.

would be applied to a small area of the tile (e.g. as when the heel is placed on the edge of the hard tile and the toes falling in the soft tile); this will contribute to the faster wearing of this section of the tile.

### **The role of intention**

There is an evident purpose when we walk through the street or when we use a staircase: to move to another place or reach a different floor level from that where we are initially. The action thus involves an intention, namely, the wish to get from one place or surface level to another.<sup>27</sup> In principle, no psychological or sociological reasons are behind the act of walking through the street or climbing or descending steps. There is solely a need to move ourselves from one place to the other as a result of our bodies being required to be somewhere else.

Staircases are an endless source of wear patterns. These last, found on the different surfaces of the staircase (i.e. the floor, balusters, handrails and walls), were produced by the action of various parts of the body, shoes, or the impact of things carried up and down, just to name a few. As such, they provide a great deal of information regarding how the stairs have probably been used. For example, plate 5.3 shows a flight of stairs where it is possible to appreciate a wear trace on the edge of some of the steps.

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<sup>27</sup> A similar situation occurs with the track on the woods described above, namely, there is an initial need to reach a place. The understanding of the reasons behind the decision to walk through the woods using that particular route (to explore the surroundings, search for food, or seek for an alternative route to reach a particular place) may contribute to the drawing of a picture of the man behind the physical action.



**Plate 5.3 Flight of stairs at the East entrance (right side) of the Old College, South Bridge, University of Edinburgh**

This trace is more evident at the right side of the bottom step and tends to move to the left in each of the subsequent steps. The basic reason behind this characteristic wear pattern is revealed when we take into account a second image of the staircase (see plate 5.4).<sup>28</sup>

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<sup>28</sup> A thorough assessment of the present condition of the stairs would require an extended analysis which, due to reasons of time and space, cannot be presented here in full. However, it is important to emphasise that the circulation pattern to be described below is only one among many possible.



**Plate 5.4 Flight of stairs at the East entrance (right side) of the Old College, South Bridge, University of Edinburgh**

Here it is possible to see that the first flight of stairs leads to a lower second one which, on the other hand, leads to the building's main entrance. Relying on this information one could infer that people tend to use this particular stairway in order to enter and exit the building. The large volume of people using this route throughout the years would explain the large amount of wear observed in some areas of the staircase.

An inspection of the wear traces present on this right-angle staircase reveals a circulation pattern that exposes a natural tendency: people usually tend to take the shortest path available. However, this does not, at any time, involve changing direction sharply. For instance, if a person familiar with the building enters it with the intention to continue to the second flight of stairs (to the right)<sup>29</sup> it is probable that he or she will tend to walk towards the right side of the first flight of stairs before reaching the second. The last step of the first flight is part also of the landing

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<sup>29</sup> In this particular case, after the first flight of stairs the person could also turn to the left or continue to walk in a straight line.

between the two flights. It is here, close to the corner formed by the walls of both flights, that one can observe a depression on the floor. This not only indicates that this is the point in the landing where people usually step before entering the second flight of stairs (in this case, either ascending or descending). Its closeness to the wall also confirms that people indeed tend to take the shortest route from one flight of stairs to the other. Immediately after this point the person would enter the second (upper) flight of stairs. The wear pattern on it, described above, tells us that after people enter the second flight they would continue to ascend following a curve leading to the left of the stairs and moving away from the wall. This would thus confirm the idea that people do not make sharp turns when exiting the first flight of stairs.<sup>30</sup>

An understanding of the wear present on other objects might presuppose the consideration of a more complex combination of objective and subjective variables. This is perhaps the case of a bronze statue of St Peter at the Vatican. Currently, the statue displays a clearly worn-out right foot (see plates 5.5 and 5.6). This condition is owed to the fact that those visitors of St Peter's Basilica who approach the statue, traditionally pilgrims, tend to stroke, and at times also to kiss, the foot. The consideration of this situation alone could help to understand the mechanical process behind the present worn-out condition of the foot, just as in the case of the stairs above. However, if one would like to try to define the motivation behind the stroking movement that causes, and has caused, wear to appear, the analysis will be considerably more difficult. In other words, the fact that the physical trace of wear is a result of a mechanical action is clear, but the intention behind the physical action, namely, what motivates the visitor to stroke the metal, is not immediately evident.

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<sup>30</sup> Needless to say, all these considerations will inevitably change when two or more people are at the same time involved in the same process of climbing or descending the stairs.



**Plate 5.5 Arnolfo di Cambio, *St Peter* (c.1300), St Peter Basilica, Vatican City**



**Plate 5.6 Arnolfo di Cambio, *St Peter* (detail)**



The statue has been kissed and touched by pilgrims for centuries.<sup>31</sup> This seems to have been a way of requesting St Peter to open for them the gates of paradise in case they would die during pilgrimage. Nowadays, the statue's role has suffered a dramatic change: from being primarily a devotional object it has become a tourist attraction. One of the reasons behind the statue's new role may be the fascination that the sight of the worn-out foot seems to exercise over tourists. But this sight alone appears not to fulfil the inner needs of the tourist's senses. For some reason the sight encourages in many a wish to rub the foot once in the immediacy of the statue, and, naturally, to request a fellow visitor to take the I-was-there snapshot.<sup>32</sup>

Whatever the motivation behind the choice to rub the foot, it may be considered by some as not relevant for the study of, and certainly not susceptible of being explained by an analysis of, the physical trace of wear. However, it is here my supposition that while the evidence of wear cannot directly reveal the source of this motivation, this last has shaped, in one form or the other, the physical movement that produced the trace of wear. This trace is thus the product of the touch of socio-culturally shaped bodies.<sup>33</sup>

This shaping can characterise in various forms the movements of the body of members of a society, or of those of individuals sharing the same professional activity.<sup>34</sup> In the case of the musician, the need to produce a particular musical

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<sup>31</sup> The statue is placed above a pedestal which situates it at approximately the height of the shoulder of an adult. For this reason, it is normally out of the reach of children and cannot be easily touched or hit but by the hand or the head.

<sup>32</sup> The presence of a specific intention behind the pilgrim's touch becomes clearer when one considers the people's wish to rub other sculptures. Two examples may suffice. First, some of the casts of the original bust of Abraham Lincoln by Gutzon Borglum (1867–1941)—in the Crypt at the centre of the Capitol in Washington—show a shiny nose as a result of the touch of passers-by. The amount of wear on some of these casts (in the collections of the White House, the Chicago Historical Society, the College of the City of New York, the Tomb of Lincoln in Springfield, Illinois, and the University of California, Berkeley) seems to reflect the curiosity and reserve of some of the visitors of the space, or the wish to get good luck as a result of touching the nose (e.g. the College of the City of New York cast is less affected than that in the tourist-crowded Springfield). A rather different study case is to be observed in the much abused life-size bronze statue of the French journalist Victor Noir (1848–1870), in the Père Lachaise Cemetery, Paris.

<sup>33</sup> For a discussion on the socio-cultural shaping of the body and its implications in keyboard performance, see chapter 2, pp. 68–70.

<sup>34</sup> Visualisation of individuals whose bodies were shaped within a different socio-cultural reality can also have an influence in the characterisation of the movements and gestures of another cultural reality. For instance, in 1935 Marcel Mauss observed that the characteristic way of walking of some

outcome might have contributed to this characterisation. The result is that the performer's body might have also acquired a distinctive physical individuality. This is clearly seen in the case of the body of a dancer, one which can be easily recognised, by the trained eye, when away from performance. In the case of the musician, the instrument calls for a particular set of movements in order to produce sound. However, performers were well aware that these movements were not to produce the desired outcome *per se*. In other words, when these movements were used in a purely mechanical form the result was not to be an effective performance. Emanuel Bach has this idea in mind when he observes that a 'stirring performance depends on an alert mind which is willing to follow reasonable precepts in order to reveal the content of compositions'.<sup>35</sup> In the same vein Forkel tells us that

[...] Man kann indessen die angeführten Vortheile alle besitzen, und doch noch ein schwacher Clavierspieler seyn, so wie jemand eine völlig reine und schöne Aussprache haben, und doch noch ein schlechter Declamator oder Redner seyn kann. Um starker Spieler zu seyn, sind noch viele andere Vorzüge erforderlich, welche Bach ebenfalls in höchster Vollkommenheit besaß.

[...a] person may, however, possess all [the advantages Bach had in his playing], and yet be a very indifferent performer on the clavier, in the same manner as a man may have a very clear and fine pronunciation, and yet be a bad declaimer or orator. To be an able performer, many other qualities are necessary, which [J.S.] Bach likewise possessed in the highest perfection.<sup>36</sup>

J.J. Quantz is the author who probably defines in a more definite way the existing differences between the impressions produced in the listener by a purely mechanical movement and those originating from the socio-cultural body of the performer. In his *Versuch* he admonishes his readers that when performing

[...] Man muß nur allezeit den Affect, welchen man auszudrücken hat, nicht aber das Geschwindspielen zu seinem Hauptzwecke machen. Man könnte eine musikalische Maschine durch Kunst zubereiten, daß sie gewisse Stücke mit so besonderer Geschwindigkeit und Richtigkeit spielete, welche kein Mensch [...] nachzumachen fähig wäre. Dieses würde auch wohl Verwunderung erwecken; rühren aber würde es niemals [...] Wer nun den Vorzug der Rührung [...] behaupten will, der muß zwar jedes Stück in seinem gehörigen Feuer spielen [...].

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Parisian women appeared to be a result of the influence exercised by American films. See Mauss, "Techniques of the Body," 79–80.

<sup>35</sup> Bach, *Versuch*, Ch. 3, Performance, § 1.

<sup>36</sup> Forkel, *Bachs Leben*, Ch. III, 14; David, Mendel, and Wolff, *NBR*, 433.

[...the] principal goal must always be the expression of the sentiment, not quick playing. With skill a musical machine could be constructed that would play certain pieces with a quickness and exactitude so remarkable that no human being could equal it ... [It] would excite astonishment, but it would never move you [...]. Those who [...] wish to touch people, must play each piece with its proper fire [...].<sup>37</sup>

In this passage, Quantz puts clearly into perspective the contrast between the effects of mechanical movements *per se* and those in which an intention is behind them. It is then the performer's awareness of the character of the music, as Emanuel Bach emphasises, the one that would help to 'make the ear conscious of the true content and affect of the composition'.<sup>38</sup> Consequently, this has to be contained in the performer's bodily attitude.

In all, the analysis above suggests that the playing of a competent performer has a cultural component that a mechanical performer or machine lacks—though one would need to keep in mind that in the preparation of the machine the builder was probably careful enough to try to make the mechanical performance as convincing as possible. In any case, the wear present in a musical instrument played by a machine would be distinct from that played by a human body. And, most probably, that

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<sup>37</sup> Quantz, *Versuch*, Ch. XII, § 11; Quantz, *On Playing the Flute*, 'Of the Manner of Playing the Allegro', § 11, 131. Quantz is referring to a mechanical flute player built by the French engineer Jacques de Vaucanson. For a discussion on the metaphysical implications of this player on music performance, see David Gaynor Yearsley, *Bach and the Meanings of Counterpoint* (Cambridge: Cambridge University Press, 2002), 174–188, especially 178–179. Another sort of musical experience seems to have been available from the playing of some mechanical organs since, in a number of cases, the barrels of these instruments were prepared by an organ craftsman skilled in music. One of these craftsmen was John Langshaw (1718–1798), who was responsible for the pinning of a number of barrels featuring Handel's music. His work seems to have been very successful, a contemporary reporter suggesting that 'the instrument played "with so much delicacy and taste, as to convey a warm idea of the impression which the hand gives on the instrument"'; quoted in Arthur W. J. G. Ord-Hume, "Ornamentation in Mechanical Music," *Early Music* 11, no. 2 (1983): 185–193, especially 186 and 189. The experiential character of this testimony seems to speak for the effect the involvement of a trained musician on the pinning of the barrel had on the performance of the mechanical instrument. Langshaw seems to have been able to transfer some of the nuances of the organist's playing into the mechanism of the mechanical organ by means of his meticulous positioning of the pins. I suggest that he was capable to shape the music played on the mechanical instrument as a consequence of his ability to reinterpret the intentional mechanical action necessary at the organ in the form of a pinning setting. In other words, a number of aspects of musical expression resulting from the physical and intentional movements of the body required while performing at the organ were translated into a pinning distribution in a barrel. The final setting would probably not have been as effective as it appears it was if the technician was not to be a performer himself.

<sup>38</sup> Bach, *Versuch*, Ch. 3, Performance, § 2. This observation suggests that some instructors were failing to create in pupils an awareness of the contents of the compositions. This would have resulted in a composition being played in a mechanical manner, this is to say, lacking the 'proper fire' as a result of an absence of the necessary intentional movements of the body.

produced by a player distinct to that of another, partly as a result of different intentions behind the visible mechanical movement.

## **Wear on historical instruments**

When one observes the key tops of historical keyboard instruments (i.e. the piece of wood, bone, ivory or tortoiseshell covering the lever's bare wood at the area where the fingers come into contact with it) it is often possible to observe wear traces which have been produced by the repeated contact between the finger and the top. This type of wear is present in a variety of shapes and depths. Its shape and distribution also fluctuates, from one instrument and key to the other, from the barely noticeable to one which leaves the underlying lever's wood visible.

It is important to emphasise the fact that in the particular case of historical keyboard instruments this trace is indeed the product of the physical interaction between the performer and the instrument, and not one originally introduced by the builder.<sup>39</sup> That the evidence of wear is indeed a product of the action of the performer can be confirmed by the characteristic wear present on an instrument by Johann Heinrich Silbermann<sup>40</sup> where one can clearly appreciate the difference between the non-worn-out keys and those affected by the action of the fingers (see plates 5.7 and 5.8).

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<sup>39</sup> An exception is an Italian harpsichord by Keith Hill, at the Musikhochschule Freiburg i.Br., which has originally been worn-out in the builder's workshop.

<sup>40</sup> The information on the instruments under discussion is found in the image's caption. The format used here is: type of instrument, builder's name, workshop location, year of building, collection/museum, city, catalogue number, keys included (only those which are visible in their entirety), observations. The abbreviations indicate the name of the museum/collection in which the instrument can be found. These are: Germanisches National Museum (Nurnberg): NGM; Musikinstrumenten-Museum (Berlin): MIM; St Cecilia's Hall Museum of Instruments: STC; Grassi Museum für Musikinstrumente der Universität Leipzig (Leipzig): GMI; The Nydahl Collection, Stiftelsen Musikkulturens Främjande (Stockholm): SMF; Musik/Teater Museet (Stockholm): MTM. For example: **Unfretted clavichord, H. Silbermann (Strasburg, 1775), NGM, Nuremberg, MIR 1061, BB-F.**



**Plate 5.7** Unfretted clavichord, H. Silbermann (Straßburg, 1775), NGM, MIR 1061, *BB-F*;  
unaffected keys



**Plate 5.8** Unfretted clavichord, H. Silbermann (Straßburg, 1775), NGM, MIR 1061, *b-f'*;  
circular wear

In this particular case the trace of wear is so distinct and characteristic that one can suggest that the instrument was heavily played mainly by one performer. He or she seems to have used a playing approach which relied on pressing the key in a very limited area at its front. After some time a clear depression appeared, one which, as will be seen, is most uncharacteristic of clavichord playing.<sup>41</sup>

It would be difficult to try to determine with any degree of certainty the amount of time the brand-new top had to be played before it would display the present trace of wear.<sup>42</sup> I suggest that, though most of the materials used to produce key tops have a high wear coefficient, the amount of playing done on some of these instruments was such that would have considerably worn out the surface in a few years' time.<sup>43</sup> That wear was already present on historical instruments around the time when they were originally built seems to be attested by Abraham van Diepenbeeck's (1596–1675) *Saint Cecilia* (c.1627–1630).<sup>44</sup> In this composition the Saint is playing a clavichord which shows a number of keys which appear to be affected by wear (see plate 5.9). The instrument, probably in the possession of Rubens (of which van Diepenbeeck was his pupil and assistant), seems to have been built long before it was ultimately used for this painting.<sup>45</sup> The contrast it offered to the viewer in its appearance when

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<sup>41</sup> This particular trace of wear was not observed in any other instrument inspected during this study. For a list of those instruments examined in detail during the present study, see appendix 9.

<sup>42</sup> The only study addressing systematically the appearance of wear in wood that I was able to unearth is Bert P. Youngquist, W. G.; Munthe, *The Abrasive Resistance of Wood as Determined with the U.S. Navy Wear-Test Machine* (Madison, Wisc.: Forest Products Laboratory, 1948). In it the resistance of a number of woods to the action of a specifically built wear machine is analysed. Although a number of the materials under study are also used in the production of key tops the mechanical action used to produce wear is radically different from that observed in keyboard playing. For this reason its results, though useful for basic reference purposes, have limited practical value in the field of keyboard wear. A study of how a specific action of the finger affects the surface of wood and bone tops still has to be attempted.

<sup>43</sup> Contemporary copies of historical instruments do not usually show a large trace of wear. This situation can be observed on instruments belonging to music universities and conservatories. Instruments in those institutions are often played for several hours a day. Despite this situation, they do not usually show a large trace of wear, even after a significant number of years. The reasons behind this situation are difficult to ascertain. Perhaps some decades are necessary before a trace of wear similar to that present on historical instruments is to be observed. Another reason might have to do with the use a physico-mechanical approach which does not correspond to that used by performers of the past.

<sup>44</sup> See Erik Larsen, *P.P. Rubens* (Antwerp: De Sikkel, 1952), 218, no. 79.

<sup>45</sup> The instrument has a soundboard underneath the keys, a characteristic which suggests it might have been built during the first decades of the sixteenth century. This instrument is similar in a number of respects to that depicted in Jan Sanders van Hemessen's *Young woman playing a clavichord* (e.g. the compass (van Hemessen: *E, F, F, A-g'', a''*; van Diepenbeeck: *C/E-a''*), the projecting keyboard, and the unornamented check pieces). For other instruments of the period sharing similar features, see

compared to more modern instruments was probably one of the reasons that drew the painter to use it here. In other words, it might have been introduced with the intention to age the composition. The wear on this instrument, perhaps exaggerated in the depiction but probably present on the original instrument, may have been depicted for the same reason, namely, in order to emphasise the extended use Saint Cecilia has been making of it.



**Plate 5.9 Abraham van Diepenbeeck, *Saint Cecilia* (detail), The Metropolitan Museum of Art, New York**

It is interesting to observe in this painting the presence of a characteristic trace of wear next to a specific use of the fingers. As will be discussed below, there are a series of finger actions which might be behind particular traces of wear. In the particular case of this painting, one can observe that the saint appears to be slightly pressing the key with a seemingly relaxed finger. This is suggested by how the first joint is bent in some fingers while it is rounded in others (e.g. right hand, the second and fourth fingers (inwardly bent) compared to the third (rounded)). Such an

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Darryl Martin, "The Van Hemmesen Clavichord and the Early Flemish Clavichord School," in *De Clavicordio III: Proceedings of the International Clavichord Symposium, Magnano, 24-28 September 1997*, ed. Bernard Brauchli, Susan Brauchli, and Alberto Galazzo (Magnano: Musica Antica a Magnano, 1998), 22–23.

approach was perhaps to produce an extended trace which might have corresponded to that depicted in the surface of the lower-octave chromatic keys. It is difficult to tell if this is an approach van Diepenbeeck had indeed observed in players of the time, if he was intuitively reconstructing the movement relying on the trace of wear already present on the instrument, or if he was just following Ruben's own depiction of Saint Cecilia.<sup>46</sup>

A similar approach to that depicted by van Diepenbeeck is to be found in Jan Steen's (1626–1679) *A young woman playing a harpsichord to a young man* (c.1659) (see plate 5.10).



**Plate 5.10 Jan Steen, *A young woman playing a harpsichord to a young man* (probably 1659, detail), The National Gallery, London**

Here, the girl at the harpsichord displays a right-hand second-finger joint inwardly bent. This bending might be, as has been suggested in the case of Ruben's *Saint Cecilia*, a consequence of both the use of a certain amount of finger pressure on the key and the presence of a relatively relaxed condition of the joint.<sup>47</sup>

<sup>46</sup> Compare the shape of the right hand with that depicted by Rubens. See above, chapter 2, p. 100 and plate 2.12, p. 101.

<sup>47</sup> See chapter 2, pp. 95 and 98–102. See also the discussion below, pp. 236 ff.



When making a correspondence between Steen's and van Diepenbeeck's paintings one could say that, if depicted, the length and shape of the wear trace in Steen's harpsichord would have been similar to that in van Diepenbeeck's clavichord.<sup>48</sup> This is to say that, since the chromatic keys of both instruments appear to have been played at some moments in a similar fashion, namely, by touching the key using the long-fingers' finger cushion, the trace of wear on each instrument would have shown some similar characteristics.

The finger cushion seems to have rubbed the chromatic keys during the release of the key. This idea has its basis on a reconstruction of the action of the fingers during the playing of these keys. The chromatic keys were certainly used less often than their natural counterparts. For this reason, it is probable that performers were to stretch the long fingers when intending to play a chromatic key, rather than to move the hand in order to help the fingers to come closer to the upper keys. This is suggested from the evidence in Steen's painting. In it, one can see that while the second and the third fingers of the right hand are playing chromatic keys, the thumb, as the little finger in the left hand, is placed in front of the natural keys, rather than above them. This situation would necessarily have required the player to extend the long fingers in order to reach the chromatic keys. Under these playing circumstances, and considering the pressure that appears to have been exercised on the key when this was at its lowest level, during the release of the key the finger cushion may have remained in contact with the key plate. The ascending movement of the key combined with the tendency of the finger to retract would have prolonged the contact between the finger's cushion and the plate until the finger was entirely removed from the plate. This situation might also have contributed to an enlargement of the wear trace.

Although this kind of analysis offers some insight into the mechanical reasons behind the process of wear appearance and accumulation, one cannot be certain that the finger actions proposed above are indeed related to the trace of wear visible in Silbermann's and van Diepenbeeck's instruments. The situation becomes more

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<sup>48</sup> The initial impression of a physical similarity between traces would change when those issues behind the production of the trace (e.g. the performer's bodily attitude, the music performed, the general mechanical approach used, and the instrument's action) are all taken into account.

complex when one attempts an analysis of the more problematic picture offered by the wear patterns present on historical instruments.<sup>49</sup> It is for this reason that the information coming from an experimental clavichord—the copy of an historical instrument equipped with high wear-rate key tops which reveal patterns of abrasion more rapidly—will be of exceptional value.<sup>50</sup> This instrument will not only provide us with information about the abrasion process caused by the finger's rubbing on the surface of the keys. The final trace left on the surface of its keys, namely, that present after the playing schedule has been completed, is expected to serve as the pattern which might help us to identify the use of a similar playing approach on some historical instrument.<sup>51</sup>

The analysis that follows will explore a number of wear traces which will be discussed based on the evidence gathered during the direct contact with the original instrument and that coming from the experimental clavichord. While a number of historical instruments from the sixteenth to the nineteenth centuries will be presented, particular attention will be given to those from the second half of the seventeenth, and the first of the eighteenth, centuries.

### **Identifying wear: different approaches, different effects**

The presence of differentiated wear in the same areas of the key in different instruments is an initial indication of variants in the approach to the keyboard. This situation can be initially illustrated through a comparison between the wear existing in two key tops belonging to two different instruments. Although the trace of wear visible in the natural keys of a fortepiano by Ignatz Heinrich Ölmütz is, when visually compared, more evident than that in a clavichord by Domenico Pisaurensis,<sup>52</sup> the *b flat* in both instruments shows a distribution of wear which does not correspond to the amount found in the natural keys (see plates 5.11 and 5.12).

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<sup>49</sup> For a discussion on two previous attempts to assign the trace of wear to a particular finger action and the problematic associated with them, see the introduction, pp. 4–5.

<sup>50</sup> See the introduction for a discussion on the use of this instrument, pp. 10 ff. For technical information on the instrument and its tops, see below, appendix 3.

<sup>51</sup> The components of the playing approach to be used on this instrument have been presented in chapter 4. See above, pp. 151 ff.

<sup>52</sup> Fretted clavichord, D. Pisaurensis (Venice, 1543), GMI, Leipzig, cat. no. 1.



**Plate 5.11 Fortepiano, Ignatz Heinrich Ölmütz (Bohemia, c.1825), STC, Edinburgh, cat. no. 4347, *b flat*'; wear caused by right thumb (right) and right fifth-finger actions (left)**



**Plate 5.12 Fretted clavichord, Domenico Pisarenis (Venice, 1543), GMI, Leipzig, cat. no. 1, *b flat*'**

It is clear that the clavichord's *b* flat key has been played very little and in a different form. On the fortepiano, the *b* flat shows also a significant amount of wear, something which becomes more evident when one compares this key to the two chromatic ones next to it (see plate 5.13).



**Plate 5.13 Forteplano, Ignatz Heinrich Ölmütz (Bohemia, c.1825), STC, Edinburgh, cat. no. 4347, *b* flat; right thumb trace (right)**

The wear in this key can perhaps be safely attributed to the use of the thumb and the fifth finger during the playing of octaves, a technique that was probably not to be used at all on the Pisaensis clavichord. This interpretation can be better appreciated when one places the hand with the intention of playing an octave *b* flat-*b* flat'. By doing so, one can clearly see that the shape, as well as the lateral angle in which the finger needs to be positioned, corresponds to the trace of wear present in the worn-out top (plate 5.14).



**Plate 5.14 Fortepiano, Ignatz Heinrich Ölmütz (Bohemia, 1825), STC, Edinburgh, cat. no. 4347, *b* flat; right-thumb placing**

This form of visual approach can help us to determine some of the reasons behind the origin of other characteristic types of wear. In some cases, however, it will be necessary to find other similar specimens which could serve to confirm our preliminary understanding of the evidence of wear. One example of this approach is provided by the comparison of the wear present on the front edge of the key head of three polygonal virginals. In these instruments one can readily observe that this section of the key, when compared with the almost non-affected key tops at both ends of the keyboard, is considerably worn out (see plates 5.15–5.21).

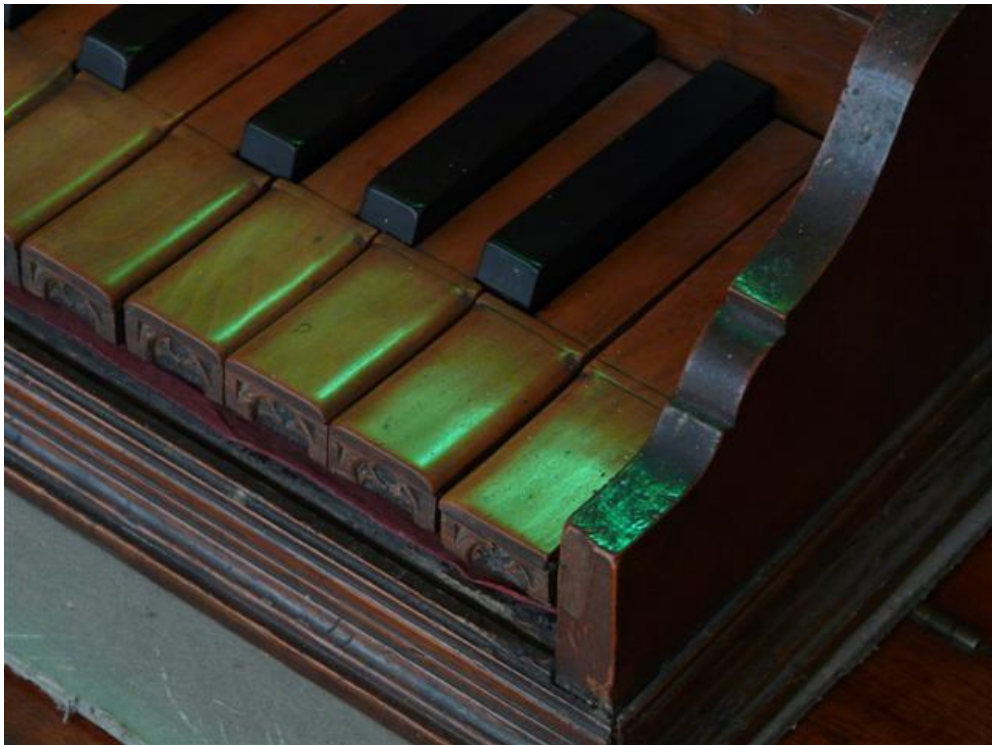




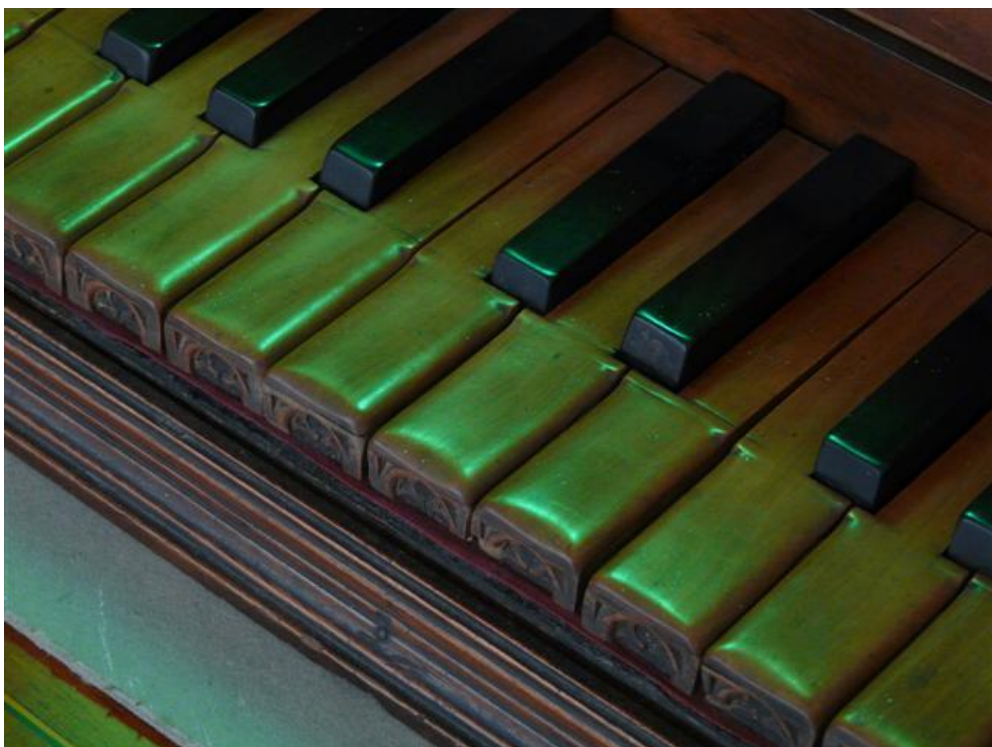
**Plate 5.15 Polygonal virginal, Domenico Pisaurensis (Venice, 1540), NGM, Nuremberg, MIR 1081, lowest keys**



**Plate 5.16 Polygonal virginal, Domenico Pisaurensis (Venice, 1540), NGM, Nuremberg, MIR 1081, *b-f'***



**Plate 5.17 Polygonal virginal, attributed to Baffo, SMF, Stockholm, cat. no. IKL056, highest keys**



**Plate 5.18 Polygonal virginal, attributed to Baffo, SMF, Stockholm, cat. no. IKL056, a-g'**



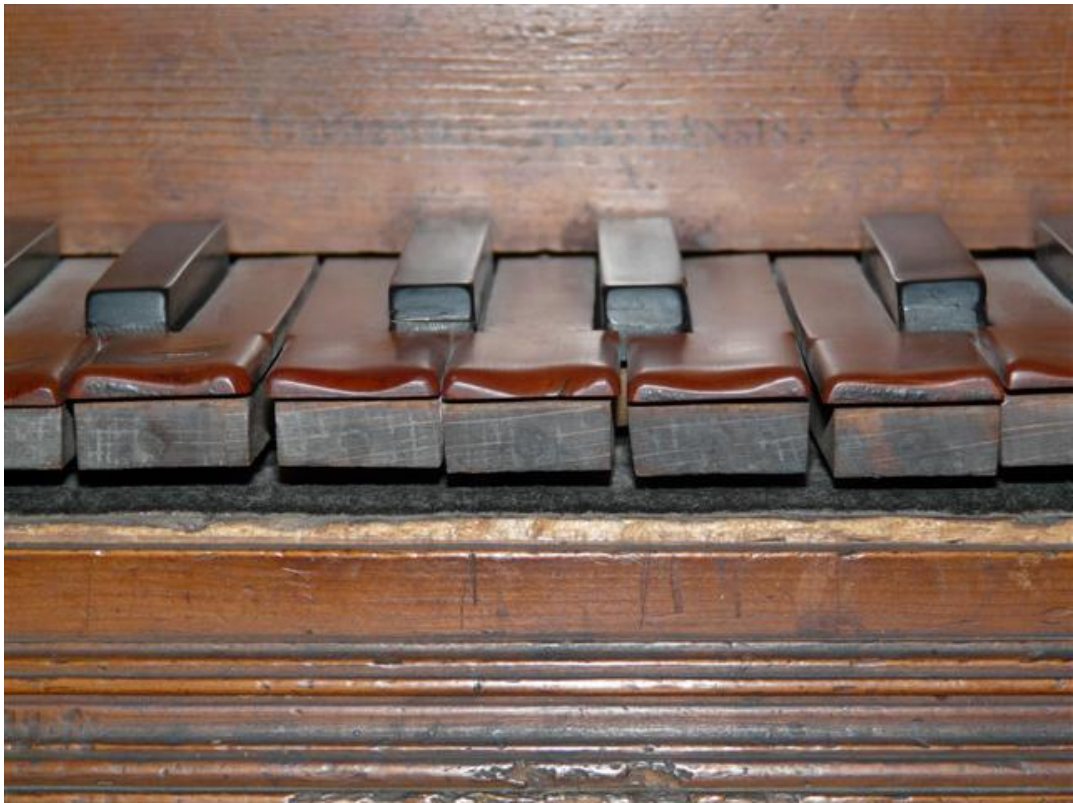


**Plate 5.19 Polygonal virginal, Domenico Pisaurensis (Venice, 16<sup>th</sup> century), MIM, Berlin, cat. no. 324, lowest keys**



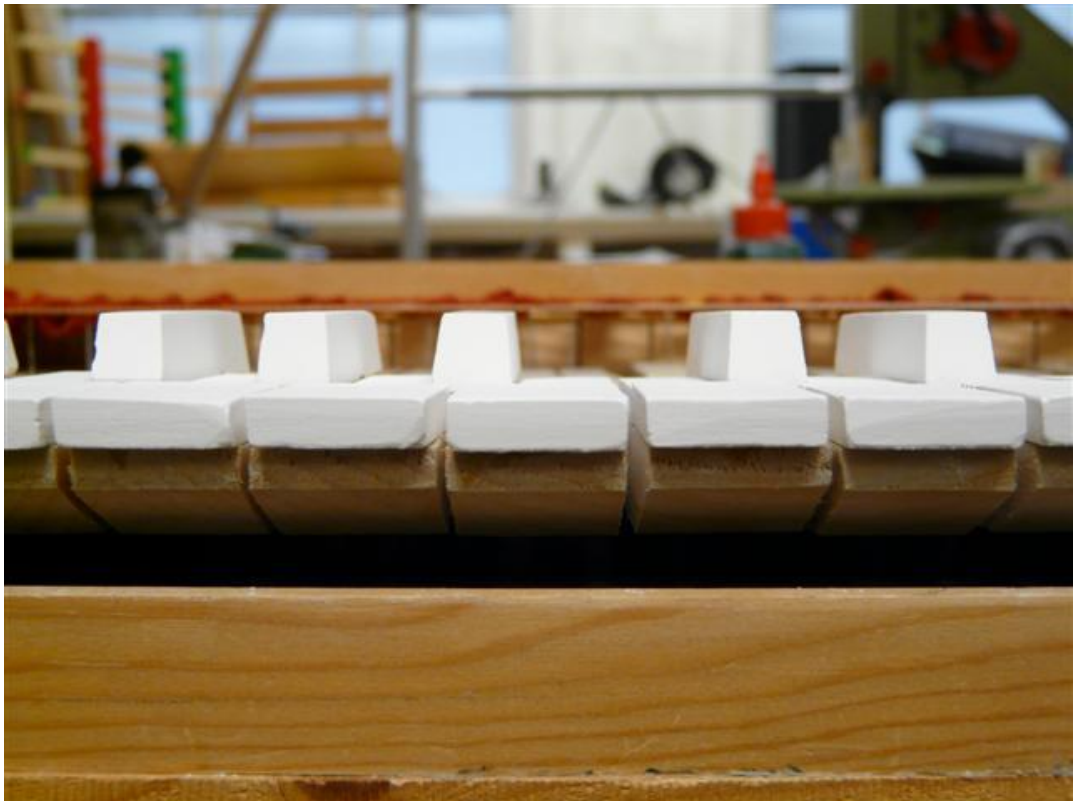
**Plate 5.20 Polygonal virginal, Domenico Pisaurensis (Venice, 16<sup>th</sup> century), MIM, Berlin, cat. no. 324, highest keys**



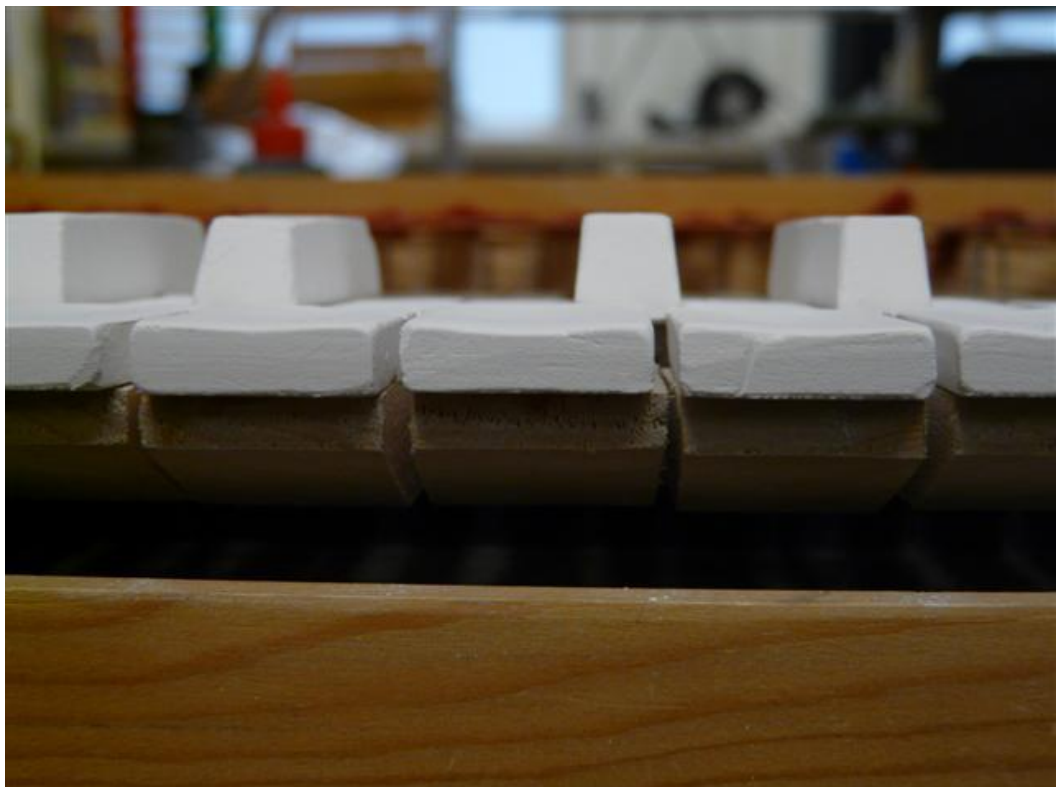


**Plate 5.21 Polygonal virginal, Domenico Pisaurensis (Venice, 16<sup>th</sup> century), MIM, Berlin, cat. no. 324, *b-f'***

By initially considering the original shape of the key one can appreciate that each of the affected keys shows an angled front edge. But in the case of the worn out key of the Berlin polygonal virginal a more acute angle than that in its Nurnberg and Stockholm counterparts is to be found. Before the reason behind these particular angles is discussed it will be necessary to briefly analyse other aspects related to the wear present on this area of the key. To begin with, this wear trace is largely a product of the action of the thumb, something which was confirmed by the evidence available from the experimental clavichord (see plates 5.22 and 5.23).



**Plate 5.22** Experimental key before wear formed by the action of the thumb, *G-d*



**Plate 5.23** Experimental key showing wear product of the action of the thumb, *B-d*

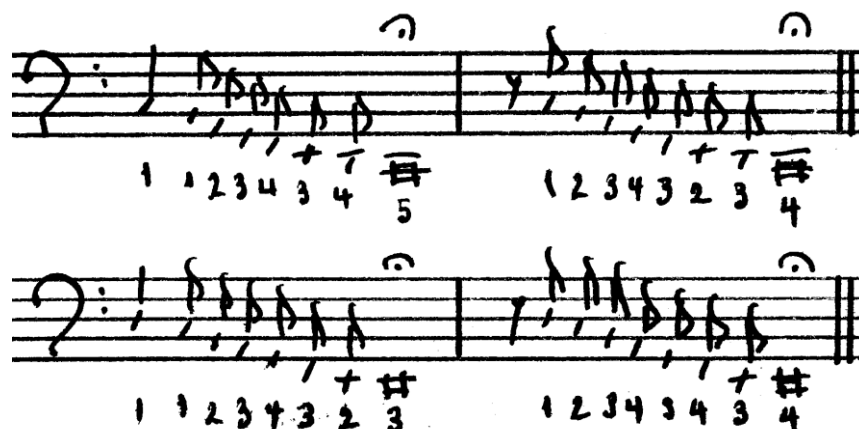
The characteristics of the distinctive trace left by the thumb in the front edge of the natural key top are a result of the short length of this finger and its biomechanical characteristics. These do not only differ from those of the other fingers, as a result of its unique anatomy, but also allow it to oppose spatially other fingers. In keyboard playing, this results in the thumb touching the front edge of the natural plate using the lateral side of the finger at the level of the distal phalanx. The contact area of the finger with the plate will mainly depend on the height of the hand and the length of the key head. Thus, it could be found between the thumb's interphalangeal joint and the nail's distal edge.

The inclination shown by the trace suggests that this was produced by a thumb striking the front edge of the top at an angled position, a situation which, as will be discussed below, might have to do with the use of a low, and perhaps also a high, position of the wrist. The more pronounced trace of wear on the right side of the Pisaurensis polygonal virginal's *c* key front edge (see above, plate 5.21) seems to be the result of the thumb's natural tendency to attack the key in a diagonal form when the fingers are separated (e.g. as in the case of the *b* flat key in the Ignatz Heinrich Ölmütz's fortepiano (see above, plate 5.14)). This position of the thumb is present during the playing of large intervals. On the other hand, some evidence suggests that there is also a possibility that part of the wear on the plate's front edge was caused by the movement from one key to another of the fourth finger during its use in paired fingerings.<sup>53</sup> Since the actions of these fingers have an impact on the same area of the plate, distinguishing their precise effect on historical instruments would be extremely difficult. In any case, the effect of each of the actions described above can be studied through the use of an experimental clavichord. There is, however, a possible piece of telling evidence that seems to speak for the effect of the fourth finger on the natural top.

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<sup>53</sup> The particular wear produced by the actions here proposed was confirmed experimentally. In the case of paired fingerings only a limited number of scales were played separately to confirm their effect on the key surface. These few tests show that wear tends to appear in the front edge of the natural key head. This is a result of the abrasion process, taking place during the release of the key, between e.g. the lateral side of the right-hand fourth finger's distal phalanx and this area of the key while playing an ascending scale with a 3–4–3–4 fingering. The fourth finger needs to perform this movement in order to be able to pass under the third and reach the next key to the right. For a discussion on the movements involved in paired fingerings, see above, chapter 2, pp. 65 and 82.

The wear trace that has been here primarily attributed to the use of the thumb is present in a number of instruments almost throughout their whole compass. As has already been mentioned, the lower and upper registers are mostly unaffected in their first and last keys (i.e. the amount of wear is not visible with the naked eye). There is, however, a small but visible wear trace in some of the lower keys of *C/E* short octave instruments. The presence of a barely visible trace of wear, particularly on the *G* and *A* plates, would seem to indicate that the thumb was in use in this area of the keyboard. The *G* is probably the last key where this finger, if this was ever used in this key, might have been of any use.<sup>54</sup> There is, however, another finger action that might be behind the trace in these keys, and which might have taken place more frequently. Tomás de Santa María recommended the use of the following fingering when playing descending *C* major and *D* minor scales (see figure 5.1):



**Figure 5.1** Fingerings for descending *C* major and *D* minor short-octave scales, Tomás de Santa María, *Arte de tañer fantasía*, f. 42 r. and v.

If used repeatedly, the fourth finger could have caused a particular amount of wear on the front edge of the *G* (*C* major and *D* minor) and the *A* (*D* minor; the *d* would be taken with the thumb) when playing these descending scales. Although in Leipzig's *Pisaurensis* clavichord there is a barely visible trace on these keys, the trace found on the *G* can very well be attributed to the action of the fourth finger while playing on this key in the descending scale situation shown above. This wear is more evident when one compares the key to those of *C* and *c* (see plates 5.24 and 5.25).

<sup>54</sup> In Santa María's proposed fingerings for short octave scales the lowest key this finger is assigned is *A*. See Santa María, *Arte*, f. 41 v., 42 r. and v.; Sachs and Ife, *Anthology of Early Keyboard Methods*, 15–17.





**Plate 5.24 Fretted clavichord, Domenico Pisaurensis (Venice, 1540), GMI, Leipzig, cat. no. 1, C-A**



**Plate 5.25 Fretted clavichord, Domenico Pisaurensis (Venice, 1540), GMI, Leipzig, cat. no. 1, G-d**

When one observes the middle section of this instrument's keyboard one will find substantial differences in the wear present throughout the front edges. Wear is more readily seen in the keys *g*, *a*, *c'*, *d'*, and *g'* (see plates 5.26–5.28).



**Plate 5.26** Fretted clavichord, Domenico Pisaurensis (Venice, 1540), GMI, Leipzig, cat. no. 1, *f-c'*



**Plate 5.27 Fretted clavichord, Domenico Pisaurensis (Venice, 1540), GMI, Leipzig, cat. no. 1, *b-f'***



**Plate 5.28 Fretted clavichord, Domenico Pisaurensis (Venice, 1540), GMI, Leipzig, cat. no. 1, *e'-b'***

Needless to say, the more evident trace of wear is the result of a more frequent use of the keys in this register. The affected keys mentioned above belong to those notes which were probably most often found at the beginning or the end of both short and long ascending and descending scalar movements. According to some historical fingering recommendations these initial notes could have been played with the thumb.<sup>55</sup> The continuous mechanical effect of this finger on the front edge of the key, next perhaps to that of an emphasis of this initial note, seems then to be behind the more extended wear trace in this section of the plate. Another example of this situation is the trace on a South German clavichord from the end of the seventeenth century. On this instrument it is possible to observe a large amount of front wear on the middle octave. But that present on *d'* is by far the most evident (see plate 5.29).<sup>56</sup>



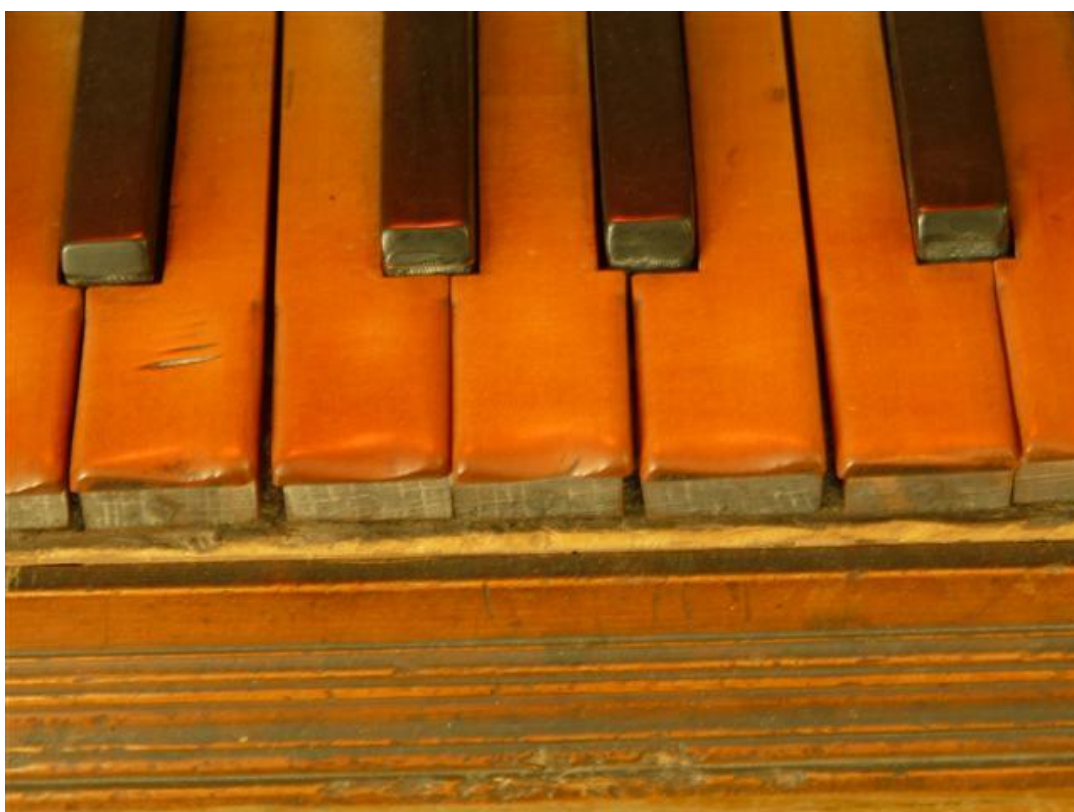
**Plate 5.29 Fretted clavichord, anonymous (south Germany, end of the 17<sup>th</sup> century),  
NGM, Nuremberg, MINE 60, *h-e'***

<sup>55</sup> One would also need to consider that the use of the thumbs in fingerings such as 1–2–3–4–1–2–3–4 would have contributed to the wear of the front edge of every key played by this finger (e.g. in an ascending right-hand scale beginning in *d* the *a* would also have been played with the thumb).

<sup>56</sup> On other possible issues behind this particular instrument's trace, see below, pp. 223 ff. The amount of wear present on a key has also to do with the frequency with which some notes are used in music. Table A.5.2 in appendix 5 illustrates this situation. This table shows the notes used in J.S. Bach's Inventions. While these data does not reveal the exact number of times a key is used during the playing of an invention, they, nevertheless, help to visualise which were perhaps the most frequently used key levers during the early eighteenth century.



A perusal of the experimental trace, considering the position of the body while playing on the experimental clavichord, helps also to suggest that the height of the wrist varied considerably among performers. This is particularly clear in the case of the Berlin Pisaurensis spinet where the angle of the trace of wear is particularly large (e.g. that formed by the natural key top's surface and the wear trace inclination). This situation might have been the result of the use of a low-positioned wrist, something which would have increased the angle between the thumb's playing surface and the horizontal plate's plane (see plate 5.30).



**Plate 5.30 Polygonal virginal, Domenico Pisaurensis (Venice, 16<sup>th</sup> century), MIM, Berlin, cat. no. 324, *h-f'***

The use of a low-level wrist while playing in a spatially average-levelled instrument might have been intended (i.e. a low wrist was probably the usual practice established among some performers). On the other hand, it could have been the result of a need to play on a keyboard which, due to its high spatial position, obliged the player to use the hand at a higher level than was customary—e.g. when the

instrument was placed above a high-level table or an organ, a common practice for the period (see plate 5.31).



**Plate 5.31 Friedrich van Falckenburg, painting on a lid of a polygonal spinet (1619, detail), NGM, Nuremberg**

The second case would have required the performer to raise the hands in order to be able to reach the spinet's keyboard. In this form the size of the angle between the surface of the key and the thumb's distal phalanx would have been increased.<sup>57</sup>

A form in which the action of the thumb might have contributed to the appearance of a more angled wear trace while using a mid-level wrist position would have occurred when this finger was to be found close to the edge of the key. This situation might have easily occurred while playing in instruments with short key heads. In this case the finger, once relaxed after playing, could have fallen from the key. During this fall the flesh next to the curved distal edge of the nail would have rubbed the front edge of the top. The presence of this situation can be again identified in Steen's *A Young Woman playing a Harpsichord to a Young Man*. Here, the thumb appears to be precisely in front of the key (see above, plate 5.10). An almost vertical fall movement of the thumb (and probably also of the fifth finger) could have then also contributed to the formation of a large-angle wear trace. However, it is probable that the effect of this action, and thus its physical extent, would not have been as large as that produced by an angled thumb playing the key. This is because in this case the thumb would have applied a larger force to the top and, therefore, a more aggressive attrition process would have taken place (see below).

The wear on the South German clavichord shown above (NGM, Nuremberg, MINE 60) seems to indicate the existence of yet another set of circumstances that might have been behind the appearance of a large wear angle. This has to do with a wear process that takes place in an already clear trace of wear. It could be described as a process in which the larger the extent of the wear trace, the greater the tendency of the trace's angle to grow. This is to be seen in the wear present in the keys *c'*, *d'*, and *e'* (see plates 5.32 and 5.33).

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<sup>57</sup> Of course, it is also possible that a performer accustomed to use a wrist at a higher level than that recommended by Santa María would have tried to keep it at the same level when playing on an instrument placed above another one. He or she would then have needed to raise the hand with the aid of the arm while keeping the wrist's position almost unaltered.



Plate 5.32 Fretted clavichord, anonymous (south Germany, end of the 17<sup>th</sup> century),  
NGM, Nuremberg, MINE 60, middle octave, *c'*, *d'*, *e'*



Plate 5.33 Fretted clavichord, anonymous (south Germany, end of the 17<sup>th</sup> century),  
NGM, Nuremberg, MINE 60, middle octave, *c'*, *d'*, *e'*

When one compares these keys with each other one can clearly observe that the wear trace on *d* is not only larger, but also exhibits a larger angle. This becomes clearer when one compares the thickness of each of these three keys at the centre of the wear trace. This evidence would suggest that another wrist angle could have been put into use when performing on this instrument.<sup>58</sup>

A more plausible interpretation of this wear trace can perhaps arise from a consideration of the wear present on the floor tiles described above (see pp. 190–192). As has been suggested, the tile at an already higher spatial level is exposed to a more direct attack from the pedestrian's foot, a situation which contributes to the formation of an angled wear on the edges of the tile. The consequent appearance of a sloping contact area, in combination with the continuous level decrease of the softer tile, would create a situation in which the higher-level tile's edge would gradually be exposed to heavier impacts from the pedestrians' feet. A similar situation occurs in the case of the key top's frontal edge. In this case, however, the contact of the finger is not as random as that of the pedestrians' feet. This is because the performer would in general try to maintain a position of the hand with respect to the keyboard which would help him to continually strike the keys in almost the same places. Nevertheless, when as a consequence of the appearance of wear the front edge of the natural top spatially recedes the thumb will not find the usual contact area. This could gradually lead to an attack of the thumb in which the top will be touched with an area of the phalanx closer to the finger's distal edge. The consequence of this situation is that the already worn out key will suffer a more vertical attack and, given the gradually smaller contact area, an initially larger finger force. These situations would contribute to both an acceleration of the growth of the wear trace on the top's edge and an increase in the size of its angle.

The angle present on the experimental clavichord seems to be considerably smaller than that found in the spinets presented above. This suggests that the level of the

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<sup>58</sup> There is, of course, no documentation to confirm the number of performers that might have played on this instrument. But even if it was played by a single one, it would be very difficult to suggest that the mechanical approach did not change throughout time or in accordance with the playing circumstances.

wrist used at the experimental clavichord was probably higher than that used on these instruments (see plate 5.34).<sup>59</sup>



**Plate 5.34 Position of the hands and wrists at the experimental clavichord**

The position adopted at the experimental clavichord is derived from a number of ideas presented by authors such as F. Couperin, J.P. Rameau, C.P.E. Bach and N.

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<sup>59</sup> As will be seen below, the angle of the wear trace on the front edge of the natural heads of this instrument seems also to be smaller than that on eighteenth-century clavichords.



Forkel.<sup>60</sup> It was decided to adopt a position that would see the lower level of the elbow, wrist and finger tips levelled as much as possible. This approach is found in F. Couperin's *L'Art de toucher le Clavecin*.<sup>61</sup> This position is also close to that seen in Gabriel Metsu's (1629–1667) *The virginal lesson* (see plate 5.35).



**Plate 5.35 Gabriel Metsu, *The virginal lesson* (c.1661), Louvre Museum, Paris**

In spite of the fact that during the tests the position of the wrist could at times fall below the level of the natural keys (though care was taken to keep it at all times at the originally proposed level), the size of the angle obtained was still significantly smaller than that found in the instruments mentioned above. It must be kept in mind that though a limited amount of playing brought out an ostensibly large trace of wear, this experimental trace might still considerably differ from any other produced under

<sup>60</sup> For the reasons behind the decision to follow these ideas, and in particular those by the *clavecinistes*, see chapter 3, pp. 148–149.

<sup>61</sup> Couperin, *L'Art de Toucher Le Clavecin*, 3.

the controlled playing conditions proposed here.<sup>62</sup> As it is, and with this in mind, the trace of wear on the experimental clavichord seems to match a number of the characteristics found in the worn-out keys of some late seventeenth- and early eighteenth-century instruments.

One reason that might be behind the particular small angle size present in the experimental clavichord's keyboard is that the knuckles were perhaps curved too much. The curvature adopted was that which helped to place the long fingers between the middle of the natural plate and the ornamental carved lines. In the particular case of my hands the resulting curvature helped to raise the thumb.<sup>63</sup> A more sunken position of the knuckles, while keeping the wrist at the same level, would have helped the thumb to come closer to the key, thus helping to increase the angle in which this finger would touch the edge.<sup>64</sup>

The considerations presented above on the origin of particular characteristics of the wear trace present on the front edge of the natural plate could help to define the height of the wrist which might have been used in specific instruments, regions and historical periods. But while the conclusions that might be reached through these efforts may always retain a speculative character, the presence of the trace in the front edge of the key seems to provide compelling evidence that the thumb was used to a large extent from the sixteenth century onwards. Care must however be taken when evaluating the trace attributed here to the action of the thumb. This is because, as has been pointed out, it might have been the result of a combination of finger actions.

The biomechanical characteristics of the thumb, which also help to increase this finger's strength, might also have helped to create a proportionally larger trace of wear than that any of the rest of the fingers could have produced. In other words, the ability of the thumb to apply larger amounts of force than the other fingers, next to the fact that this force is applied to an area of the key which is more prone to wear,

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<sup>62</sup> For a discussion on the problematic arising from the use of plaster tops, see below, appendix 6.

<sup>63</sup> It is important to observe that the thumb's striking angle will also vary depending on the proportional length of the thumb to the rest of the fingers.

<sup>64</sup> The position of the wrist was not only to affect the thumb's action, but also the length of the long fingers' displacement when gliding-off in an unforced manner. See the discussion below, p. 233.



might have caused it to create a much larger trace than that which would correspond to the perhaps limited use of the finger.

The biomechanical characteristics of the thumb also help to create a distinguishing trace which can probably only be attributed to the action of this finger. In some instances, the shape of the front wear trace indubitably reveals the identity of the thumb which was mostly to operate in a particular key. In the instruments shown below it is possible to identify a pattern of the trace which, as in the case of the *b* flat keys of the Ignatz Heinrich Ölmütz's fortepiano, reveal the positioning of the thumb (see above, plates 5.11, 5.13 and 5.14).

The impact caused by the thumb on the key, and perhaps also that produced by the action of other fingers, might be connected only with difficulty to the amount of time necessary to produce the trace. Moreover, it is perhaps not possible to speak with any degree of certainty about the amount of time that any given instrument was in use, not to say anything about the number of performers that might have played on it. In spite of this, the study of the wear trace on the front of the key could lead to an understanding of the differentiated use of the thumb, and that of paired fingerings.

### **Wear on the central part of the natural key top**

In his 1650 *Traité de l'accord de l'espinette*, Jean Denis argues that

[t]here are some masters who have their pupils place their hands in such a way that the wrist is lower than the hand, which is very bad, and properly speaking, a vice, because the hand no longer possesses strength. Others make one hold the wrist higher than the hand, which is a fault because the fingers then resemble sticks, straight and stiff. For the proper position of the hand, the wrist and the hand must be at the same height; in other words, the wrist must be at the same height as the large knuckle of the fingers.<sup>65</sup>

Vincent Panetta has suggested that the position Denis recommends resembles that found in Jan Steen's *The music master* (see plate 5.36).

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<sup>65</sup> Jean Denis, *Traité De L'accord De L'espinette* (Paris: Robert Ballard, 1650), 37; translation in Jean Denis, *Treatise on Harpsichord Tuning*, ed. Vincent J. Panetta (Cambridge: Cambridge University Press, 1987), 97.



**Plate 5.36 Jan Steen, *The music master* (c.1660, detail), Wallace Collection, London**

The height of the wrists in this image resembles that present in van Diepenbeeck's *Saint Cecilia*, and Steen's own *A young woman playing a harpsichord to a young man* (see above, plates 5.9 and 5.10). One of the clearest differences between the position of the hands in these three paintings and those seen in Metsu's *The Virginal player* and the experimental clavichord is perhaps the height of the knuckles and the level of these last with respect to that of the wrist.<sup>66</sup> As I will suggest in the following paragraphs, these were probably among the most distinguishing characteristics of the physical approach adopted by a large number of keyboard players during the second half of the seventeenth century. The reasons behind the decision to embrace any of these approaches were perhaps related to the requirements of particular keyboard idioms and the instrument's touch. In all, the use of any of these positions was to have an effect on the mechanical action of the finger, something which was to effectively have an impact on the manner in which the key plate was to be attacked, and, as a consequence, in how its surface was to wear out.

<sup>66</sup> As has been mentioned above, the wrist position used while playing the experimental clavichord was chosen after having considered a number of discussions found in historical French and German treatises and reports. See above, note 60.

Denis's indication that the height of the wrist must be that of the large knuckle of the fingers is problematic as he does not indicate how much these need to be curved. In any case, by following his indication the wrist and the dorsal side of the hand would come to be at about the same height. This situation might, on the one hand, affect the finger's natural tendency to glide in the direction of the palm (supposing that this movement is required); on the other, it appears to favour the bending of the first finger joint, thus allowing the performer to exercise pressure on the key plate in a distinctive way. In the case of the plucked-string instrument this type of contact with the key surface, namely, by using the finger's cushion, may help the player to achieve a finer manipulation of the elasticity of the quill since the cushion serves also as a spring which aids in a regulation of the force applied to the plectrum. This type of action might have been especially useful when playing slow notes, helping the performer to make the sound to bloom, i.e. to swell during the initial decay of the string's sound.

One of the reasons that lead me to adopt a position similar to the one found in Metsu's *The Virginal player* is the fact that by using this position the action of the tendons is not disrupted by an excessive curvature of the wrist (see below). But while I have decided to adopt a position of the hand in which the knuckles are curved, one in which these are slightly sunken might have brought forth some desirable playing advantages. Charles Burney reports that Handel's hand

was so fat, that the knuckles, which usually appear convex, were, like those of a child, dented, or dimpled in, so as to be rendered concave; however, his touch was so smooth, and the tone of the instrument so much cherished, that his fingers seemed to grow to the keys. They were so curved and compact when he played, that no motion, and scarcely the fingers themselves, could be discovered.<sup>67</sup>

One of the possible advantages of Handel's approach is that the finger can be projected in the direction of the key by using the accumulated energy of the sunken knuckle. This can be explained as follows: when the arm and the hand are kept at a horizontal position the fingers will naturally fall. If the fingers are raised until the point where the dorsal side of the hand and the proximal phalanges form an almost

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<sup>67</sup> Charles Burney, "An Account of the Musical Performances in Westminster Abbey, and the Pantheon, May 26th, 27th, 29th, and June the 3rd and 5th, 1784, in Commemoration of Handel," *The Monthly Review; Or, Literary Journal* 72 (1785): 281–282.

straight line, and then they are released, they will fall as a result of both the force of gravity and the natural tendency of the relaxed fingers to move in the direction of the palm of the hand. However, when the finger is raised at a level which causes the knuckle to sink the force with which the finger will fall when released will be considerably higher. The reason for this is that when the knuckle is led to adopt a convex form the muscles are brought towards the point in which they reach their maximum stretching (on the other hand, the situation in which the muscles that help to move the fingers are relaxed is visually defined by the concave curving of the knuckle). Just as in the case of a highly-stretched rubber band the muscle will try to recover its rest position in a more forceful way.

In the situation just described, the knuckle will work as an axis from which the finger will be catapulted. Thus, under these circumstances the performer will be in the position to increase the force applied to the key.<sup>68</sup> Although Burney's report appears to refer to Handel's performance at the harpsichord—the use of this approach at the occasion being perhaps the result of habit, or playing on a firmly-quilled instrument—this approach may have been particularly useful when playing at the organ where the action could at times have become excessively heavy. It will be difficult to say if this type of finger action was learnt on the clavichord. Given that this instrument was also to provide the basis for the study of the harpsichord it is probable that a more neutral touch was initially used at it, namely, one in which the knuckle was curved.<sup>69</sup>

Care to find and keep the right position with respect to the level of the keyboard is necessary, as too high or low a level might cause tiredness in the hand. In order to avoid this Friedrich Wilhelm Marpurg observes that the tips of the fingers, the lower

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<sup>68</sup> If the knuckle is generally kept sunk, the middle finger's joint can be used as its main axis. In this form the visual impression of the movement of the finger, particularly when viewed from above, might lead some observers to suggest that 'no finger motion' is present.

<sup>69</sup> In bar 24 of the fingered version of Bach's *Praeambulum* BWV 930 the right-hand consecutive *d''-e flat''* are respectively fingered 3–5. When non-consecutive short-long fingers play in a reduced area, at different spatial levels, and using a sunken knuckle, muscular tension might appear: depending on the proportional length of the fingers, the use of a sunken knuckle can hinder the ability of the shorter fifth-finger's fingertip to come close to that of the longer third one. On the other hand, the use of a curved knuckle makes the playing of these consecutive notes easy while helping to avoid muscular tension. Needless to say, the short duration of this particular muscular-tension situation does not necessarily indicate that the whole piece could not have been played comfortably using sunken knuckles.

part of the wrist and the lower part of the elbow should find themselves at the same level.<sup>70</sup> This description seems also to describe the position of the hand found in Metsu's *The Virginal player*. A curved knuckle would also allow the finger to move with ease. However, this movement can be greatly affected by the height of the wrist with respect to the hand and the arm. A neither too low nor too high wrist will allow the finger to glide easily. This is as a result of the tendons connecting the fingers with the muscles on the arm being allowed to move freely, a situation which is hindered when the wrist is excessively bent. Ideally, the player wishing to benefit from the advantages provided by a finger that can without difficulty glide on the key would search for the position of the wrist which would make it possible for the fingers to move in the direction of the palm as freely as possible. As will be seen, if used in a reiterated form this extended movement would help to produce a lengthy groove on the surface of the key plate.

On the experimental clavichord the wrist was to be spatially placed at a lower level than that of the highest knuckle. As will be shown, the result of the position had an important effect on the gliding-off movement of the finger in the direction of the hand, namely, it became slightly shorter than that observed when the wrist was placed at a higher level. Behind the decision to choose the aforementioned wrist level was that, by adopting it, tiredness in the wrist was altogether avoided. In other words, convenience was also taken into account when deciding to keep the wrist at the chosen level. The decision was also taken on the grounds of the shock-absorber function of the knuckle as an extended finger would be less able to resist the string's reaction.

The gliding-off movement is also facilitated by the finger being kept bent as this bending will help to reduce the contact area between the finger and the key. On the other hand, when the finger is less bent the possibility that the contact area of the finger with the plate could grow is increased. This can in part be a result of the height of the knuckle: when this is less curved the proximal phalanxes can come to be in an almost parallel plane to that of the surface of the keys. This shape of the hand and

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<sup>70</sup> Marpurg also comments that the hand cushions (*Handballe*, namely, the palmar protrusions close to the wrist formed by the thenar and hypothenar muscles) should never be in a slanted relation to the elbow. See Marpurg, *Anleitung Zum Clavierspielen*, Introduction, § 6.

fingers is found in Bernardo Licino's (c.1489–1565) *A concert*, and in two paintings of *St Cecilia* by Carlo Dolci (1616–1687) (see plates 5.37–5.39).



**Plate 5.37 Bernardo Licinio, *A concert* (c.1520–1525), The Royal Collection, Her Majesty Queen Elizabeth II, London; by permission**



**Plate 5.38 Carlo Dolci, *St Cecilia at the organ* (1671), Gemäldegalerie, Dresden**



**Plate 5.39 Carlo Dolci, *St Cecilia at the organ* (second half of the 1640's), Hermitage Museum, St Petersburg**

As has been observed above (see chapter 2, pp. 102–108 and 135–138), when playing on the organ and plucked instruments the initial resistance of the key would have required a strong action of the finger at the key's upper level. A less curved knuckle, perhaps even a sunken one, might have facilitated the lowering of the key. But the combination of a relatively heavy instrument, a relaxed first joint, and a certain amount of pressure over it (but lower than that necessary to open the organ's pallet or pluck the string) could, in some cases, have caused the joint to bend. As I have suggested above, this bending might have helped to manipulate the quill. Although the depiction seems to present a relaxed non-playing group of Italian musicians, the hands of two harpsichordists in the same number of paintings by Anton Domenico Gabbiani (1652–1726) seems to illustrate this handling of the key (see plates 5.40 and 5.41).



**Plate 5.40** Antonio Domenico Gabbiani, *Musicians at the court of Crown Prince Ferdinando de' Medici* (c.1687), Galleria Palatina, Florence



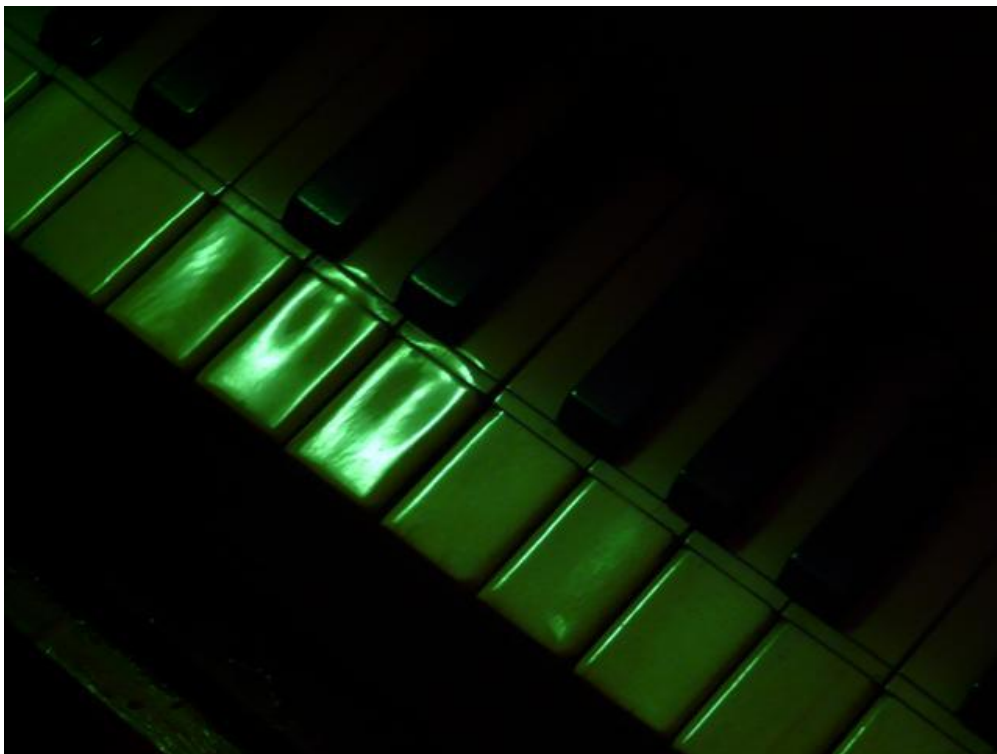


**Plate 5.41 Antonio Domenico Gabbiani, *Three Musicians of the Medici Court* (c.1687, detail), Galleria Palatina, Florence**

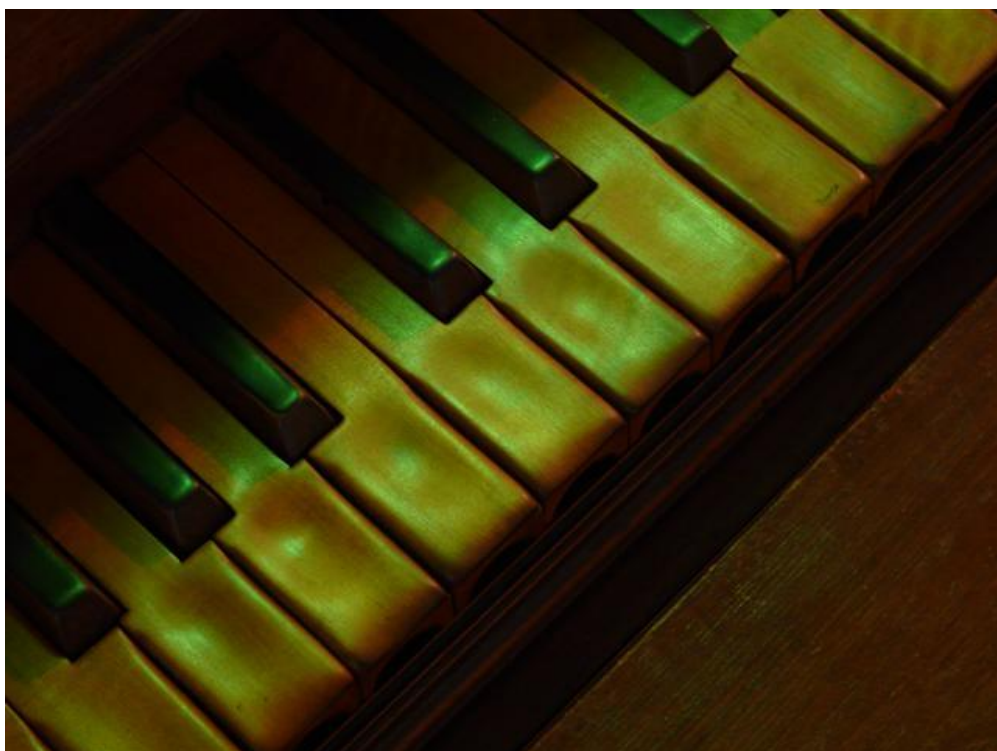
All in all, the bending of the first finger's joint may cause the gripping area between the finger and the key to grow, something which will result in the finger gliding off the key with difficulty.<sup>71</sup> A cavity might then appear on the surface of the key top as a result of a continuous contact of the finger cushion with the key top. However, unless the finger is withdrawn forcefully a deep wear trace will grow in a limited area of the top, namely, close to the place where the finger initially touched the plate. The latter way to remain in contact with the key will be referred to as the gripping touch. The effect of this touch is perhaps behind the trace found in some harpsichords, such as that attributed to Domenico Pisaurensis or a spinettone attributed to Bartolomeo Cristofori (see plates 5.42 and 5.43).

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<sup>71</sup> The cushion's area in contact with the top will grow or shrink depending on how far away from the hand the fingertip is.



**Plate 5.42** Single-manual harpsichord, attributed to Domenico Pisaurensis, SMF, Stockholm, cat. no. IKL057, *H-a*



**Plate 5.43** Spinettone, attributed to Bartolomeo Cristofori (Florence, c.1720), GMI, Leipzig, cat. no. 86, *g'-g''*

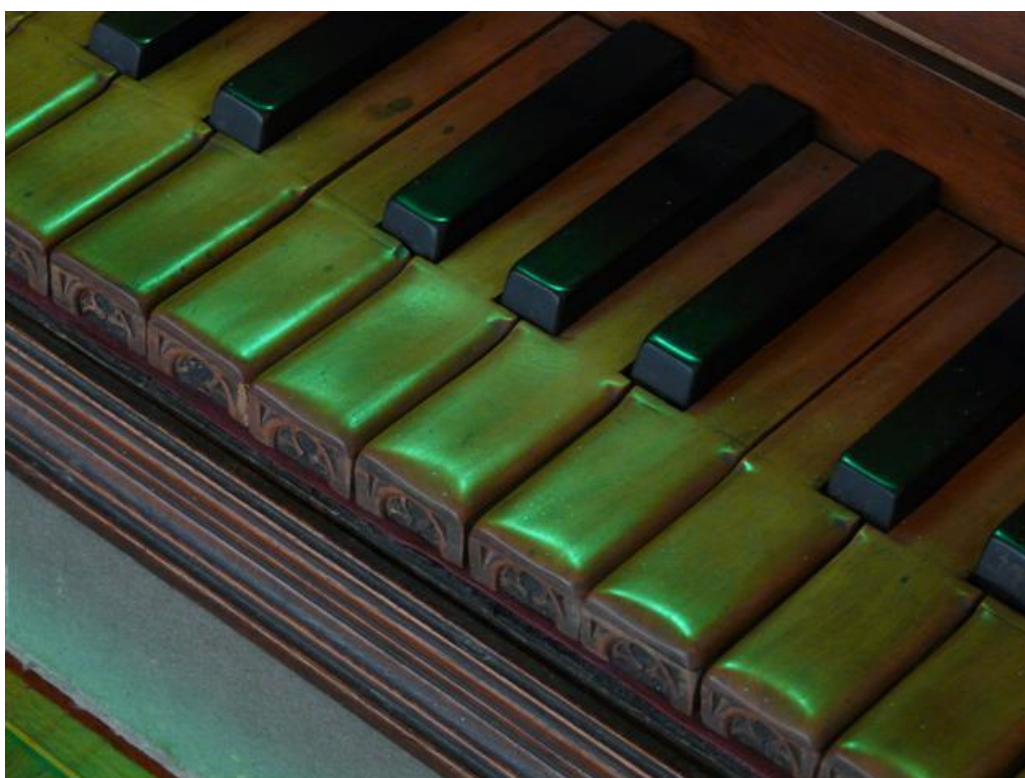
A constant use of the gripping touch might have been behind the general undulating appearance of some instruments such as that present in a number of Italian instruments (see plates 5.44–5.47). As will be seen, this trace is in clear contrast to that found in a number of clavichords.



**Plate 5.44** Single-manual harpsichord, Antonio Migliai (1702), GMI, Leipzig, cat. no. 82,  
*f-e'*



**Plate 5.45 Spinettone, attributed to Bartolomeo Cristofori (Florence, c.1720), GMI, Leipzig, cat. no. 86**



**Plate 5.46 Polygonal virginal, attributed to Baffo, SMF, Stockholm, cat. no. IKL056, e-d'**





**Plate 5.47 Polygonal virginal, Domenico Pisaurensis (Venice, 1540), NGM, Nuremberg, MIR 1081, *g-f'***

The gripping touch can be seen in direct opposition to Emanuel Bach's clavichord rubbing one. As has been pointed out in chapter 3, Emanuel's 1753 description of touch might reflect the changes undergone by his physico-mechanical approach to the keyboard during the 1740's. These could in part have originated from his contact with the instruments available to him in Berlin during this decade, as well as his less frequent performances at the organ.<sup>72</sup> Thus, it is probable that for a considerable number of players the clavichord was no longer the instrument used to prepare for a performance at the organ, but the instrument where performance was actually to take place. Given the general characteristics of the touch of the clavichord, the fingers would have been required to apply force at the bottom of the key and resist the reaction of the string. These two conditions can be easily satisfied through the use of a bent finger (which can apply force to the clavichord's key in a more effective and controlled way than by using an extended finger and a flexible first joint (see chapter 3, p. 135)). The use of a curved finger—that results in the touching of the key top

<sup>72</sup> See above, chapter 3, notes 45 and 56.

with the finger's tip, rather than the cushion—would also have allowed it to glide in a relatively easy form from the point at which the initial contact with the key took place. The facility with which this movement can be implemented will nevertheless depend on the amount of pressure applied to the key, the amount of grease accumulated between the finger and the top, and some of the mechanical characteristics of the material with which the top is made.<sup>73</sup> Maintaining constant pressure throughout the movement of the finger along the length of the plate while releasing the key (e.g. when the articulation between notes was to be shortened) would also have helped to increase and lend uniformity to the depth of the trace of wear. The impact of this playing approach can be recognised in the wear trace left by this type of playing which is characterised, as has been pointed out, by the presence of a rather long groove on the surface of the key plate (see plates 5.48–5.65).



**Plate 5.48 Fretted clavichord, anonymous (Germany, c.1752), MIM, Berlin, cat. no. 227, e-b; initial wear**

<sup>73</sup> One needs to take into account that certain key tops could allow the finger to glide more easily than others. The value of the static-friction coefficient ( $\mu_s$ ), which depends on the mechanical characteristics of the two surfaces in contact, will thus primarily depend on the top's particular material and the condition of the top's surface. This coefficient can also be altered as a result of the presence of substances such as finger grease and dirt. The use of oil on wood tops would also have affected the gliding-off movement of the finger. For some considerations on the abrasion process on various materials, see appendix 6.



Plate 5.49 Fretted clavichord, anonymous (Germany, c.1752), MIM, Berlin, cat. no. 227, *b-f*; initial wear



Plate 5.50 Experimental clavichord (19/10/2011), *d-b*





**Plate 5.51 Fretted clavichord, anonymous (c.1700), MTM, Stockholm, cat. no. N264785,  $e'-b$ <sup>74</sup>**



**Plate 5.52 Experimental clavichord (19/10/2011),  $e'-c''$**

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<sup>74</sup> There is evidence on this instrument suggesting that some of the natural tops were glued again after having become loose. In some cases one cannot assert that these were placed again on the key lever to which they originally belonged. For this reason, caution has to be exercised when interpreting this instrument's wear patterns.





Plate 5.53 Fretted clavichord, J.C. Fleischer (Hamburg, 1722), SMF, Stockholm, cat. no. IKL046, *g-e'*



Plate 5.54 Fretted clavichord, J.C. Fleischer (Hamburg, 1722), SMF, Stockholm, cat. no. IKL046, *f'-d''*



Plate 5.55 Fretted clavichord, J.C. Fleischer (Hamburg, 1722), SMF, Stockholm, cat. no. IKL046, *b'-g''*



Plate 5.56 Experimental clavichord, (19/10/2011), *g-e'*



**Plate 5.57** Experimental clavichord, (19/10/2011), *a'-f''*



**Plate 5.58** Unfretted clavichord, H.A. Hass (Hamburg, 1744), SMF, Stockholm, cat. no. IKL048, *e-f'*





Plate 5.59 Unfretted clavichord, H.A. Hass (Hamburg, 1744), SMF, Stockholm, cat. no. IKL048,  $f'-f''$



Plate 5.60 Experimental clavichord (21/10/2011),  $g'-e''$



Plate 5.61 Unfretted clavichord, J.A. Hass (Hamburg, 1748), GMI, Leipzig, cat. no. 26,  
*b'-f''*

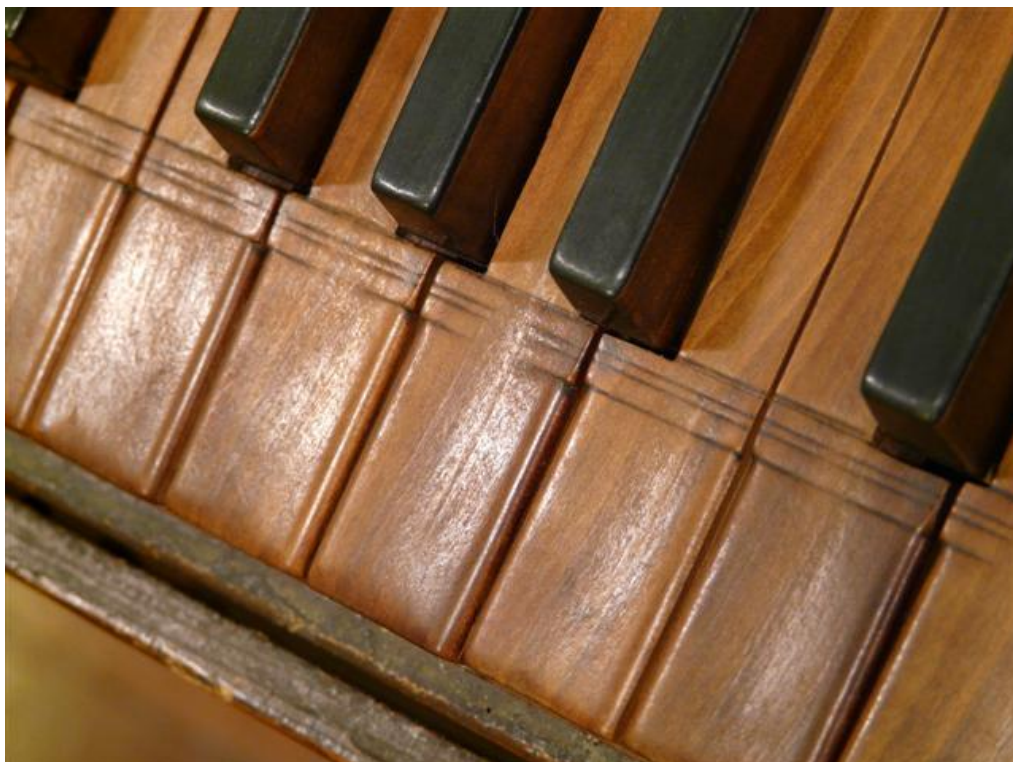


Plate 5.62 Experimental clavichord (23/10/2011), *c''-b''*





**Plate 5.63 Unfretted clavichord, anonymous (Dresden? c.1740), STC, Edinburgh, cat. no. 4487, *g-c'***



**Plate 5.64 Unfretted clavichord, anonymous (Dresden? c.1740), STC, Edinburgh, cat. no. 4487, *f'-b'***



**Plate 5.65 Experimental clavichord (19/10/2011), e-c'**

As has been suggested above (see chapter 2, pp. 86 ff.), the reasons behind this specific use of the finger could in part have to do with the particular characteristics of the musical idioms of the periods in which these instruments were mainly played. The experimental clavichord, where the finger was retracted in a forceful form during the playing of a number of fast passages in the Inventions, reveals a long groove similar to that found in Hass instruments, thus hinting at the use of this mechanical approach on the instrument.

It will be difficult to try to establish if performers consciously adopted a distinctive mechanical approach when playing on either the harpsichord or the clavichord. The evidence found on the Leipzig Pisaurensis clavichord, when compared to that available from the Leipzig Hass, suggests that this was the case. For instance, the wear present on some of the keys of the Leipzig Pisaurensis clavichord resembles more that found on the 1744 and 1748 Hass instruments and the 1722 Fleischer rather than the one on the Stockholm Pisaurensis (A) harpsichord (see below, plates 5.66–5.68, and above, plates 5.58–5.59 (Hass 1744) and 5.61 (Hass 1748)). This

likeness among the traces of wear would suggest that at least a number of aspects of the mechanical approach to the clavichord were similar at various periods and geographical regions, and that a differentiated approach might have been found in a number of performers. The withdrawing of the fingers seems to be one of these mechanical approaches. As I have suggested above (see chapter 2, pp. 88–89), a playing instance in Buchner's music which appears to demand the use of the withdrawing of the finger is that of a four-note turn. In bar 8 of *Quem terra Pontus* (see above, plate 2.4) Buchner seems to indicate by means of a specific fingering that this turn has to be played by using a withdrawing movement of the finger. The repeated effect of this movement, probably present in other musical situations, is perhaps one of the reasons why a long concave-shaped groove formed on the surface of the keys of instruments such as the Leipzig Pisaurensis clavichord.



**Plate 5.66** Fretted clavichord, Domenico Pisaurensis (Venice, 1540), GMI, Leipzig, cat. no. 1, *B-a*



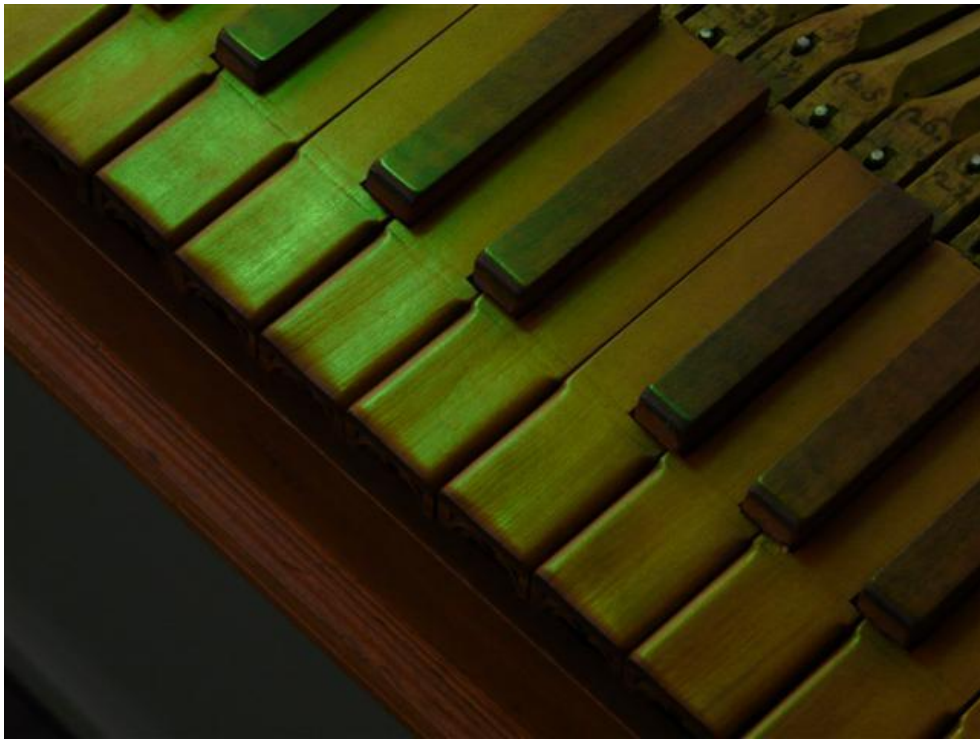


Plate 5.67 Fretted clavichord, Domenico PISAURENSIS (Venice, 1540), GMI, Leipzig, cat. no. 1, *a-a'*



Plate 5.68 Fretted clavichord, J.C. FLEISCHER (Hamburg, 1722), SMF, Stockholm, cat. no. IKL046, *b'-f''*

Some of the particular differences between the traces of wear found on the experimental clavichord and the 1748 Hass might have to do with the mechanical characteristics of the materials of the tops on each of these instruments.<sup>75</sup> In any case, the differences observed between the trace of wear resulting from the probable use of the gripping and the rubbing touches point to a differentiated use of the finger, particularly in relation to the use of a gliding movement. At the same time, the extent of the area and depth of the trace present on the plucked instruments shown above seems to indicate the possible use of a larger finger force than that required on the clavichord. This force, I suggest, is mainly needed to bend the quill. However, the wear trace might also have been enlarged in its area and depth as a result of the use of mechanical movements aimed to manipulate the quill before this was to pluck the string. Thus, the characteristic wear trace usually located close to natural key's scored lines might have been the result of the 'necessary finger strength' Emanuel Bach pointed out was required to activate the harpsichord's jacks.<sup>76</sup>

The length of the wear on the natural top on the Hass instruments and that by Fleischer could also be the result of a merging of the frontal and central wear traces. In the natural head there is one point in which two wear traces, if these are sufficiently extended, would converge. On the clavichords by Hass it is possible to observe a concave-shaped groove of a more or less uniform depth throughout the length of the top. Towards the front edge of the natural key, at the point in which the finger's pressure is released when a long gliding-off movement is used, the depth of the trace is usually less deep. Depending on how close the limit of this wear trace is to the front edge it could merge with that produced by the thumb. The consequence will be the presence of a long uninterrupted depression which would be visible throughout the whole playable surface of the top.

A number of movements resulting from particular finger actions might have also contributed to the production of a long and continuous trace. Among these probably were those involved in paired fingerings, and those of the thumb when this finger had to play in a section of the natural top closer to the centre of the head. The use of the

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<sup>75</sup> On this issue, see appendix 6.

<sup>76</sup> See above, chapter 3, p. 137.

thumb in this manner probably became more common as a result of the gradual use of a larger tonal palette, something which might have forced some performers to place the thumb, when the other fingers were playing on chromatic keys, inside the top, rather than closer to the front edge. The effect of the action of the thumb under these circumstances would become more evident when the natural key plate was longer than average, in which case players could have been forced to place the thumb further within the natural plate. In this form the separation between the central trace of wear and that produced by the thumb on the edge of the key would become a continuous groove that was to occupy the whole of the length of the plate.

### **Chromatic keys**

The study of the wear trace visible on the chromatic top (when present) and the various surfaces of the chromatic block has proven difficult. This is partly as a result of the variety of materials from which the top is made, and which often possess a different wear rate coefficient to that of the natural plate. As a result of this situation, comparison among both rows of keys and among various instruments is problematic. Moreover, given the difficulty in establishing the repertoire which would have been performed on individual instruments it would be difficult to establish the amount of use the chromatic key row sustained. In spite of this situation, at least one important aspect of the mechanical approach to the key will be advanced here.

I have suggested above that the presence of a trapezoidal-shaped key block was probably intended to help performers to reduce the length of articulation. This was to occur through the use of the sloping surface. This section of the key's surface would have aided the finger to remain in contact with the lateral walls of the block once the finger had left the upper area of the block. The presence of an interaction between the sloping walls and the fingers can be observed in a c.1752 anonymous German clavichord (see plates 5.69–5.71).



Plate 5.69 Fretted clavichord, anonymous (Germany, c.1752), MIM, Berlin, cat. no. 227,  
*c#'''-e flat'''*



Plate 5.70 Fretted clavichord, anonymous (Germany, c.1752), MIM, Berlin, cat. no. 227,  
*f#-b flat*





**Plate 5.71** Fretted clavichord, anonymous (Germany, c.1752), MIM, Berlin, cat. no. 227, *f#-b flat*; notice the rounded front edges. Compare with those of the short octave key.

The worn-out sections of the block on this instrument suggest that on a number of occasions the finger was to remain in contact with the block edges and walls during the release of the key. One should not go so far as to assure that the trace was produced by an at-all-times conscious choice to slow down the release of the key. However, and considering that these keys were probably used in a less frequent manner, the evidence present on the short octave of this instrument suggests that the finger was not to touch the lateral walls of the block unless it was necessary (see plates 5.72–5.73).



**Plate 5.72** Fretted clavichord, anonymous (Germany, c.1752), MIM, Berlin, cat. no. 227, short octave; notice that the *D* and *E* keys' front edges are not as worn out as those of *B* flat. See also below, plate 5.75



**Plate 5.73** Fretted clavichord, anonymous (Germany, c.1752), MIM, Berlin, cat. no. 227, short octave from the left side; notice the more defined left-side edge of the *D* and *E* keys.

In the keys for *D* and *E* it is possible to observe that the lateral walls are not as affected by the action of the finger as those of the *B* flat. This was probably a consequence of the use of a finger action whose movements were largely limited to the upper surface of the key since the *D* and *E* could not be connected to the normally immediate diatonic notes. In all, one cannot rule out that the trapezoidal-shaped block was used to manipulate the key's release speed, a resource that might have been exercised by a number of performers among whom one might have found J.S. Bach.

# Conclusions

The basic principles regulating the relation between the keyboard of an instrument and the performer's hand are 'the shapes of our hand and the keyboard'. This correlation, which arises from the necessary interaction between these two physical entities, was recognised by Emanuel Bach in his 1753 *Versuch*.<sup>1</sup> Yet, it is one which was to define the manner in which performers handled the instrument since the time when the medieval organ gained a keyboard. The topology and spatial positioning of the earliest medieval keyboards determined to a large extent how the body was to be used at the instrument. At the same time, particular biomechanical aspects clearly delimited the way in which performers could handle the early keyboard. Throughout time, a number of circumstances were to redefine the relation between the keyboard and the body's biomechanical characteristics (e.g. the space between the keys, the introduction of polyphonic playing, the spatial positioning of the keyboard, a more frequent use of the difficult keys, etc.). However, 'the shapes of our hand and the keyboard' remained central when changes in the playing approach were required. For instance, Emanuel Bach's observation that paired fingerings work particularly well when playing on the easy keys is connected to an awareness that the use of the turn of the thumb requires more space for this finger to operate unobstructed. This space is created when the long fingers have to play on the keyboard's chromatic keys.

One of the main aims of this study was to attempt an initial exploration of the wear trace on historical instruments, probably one of the most valuable evidences of the activity of the body in performance. This required bringing into focus the pre-eminent role the organology of the keyboard has played in the development of a number of distinctive approaches to the keys. In this form, a clearer picture emerged of how a number of characteristics of the instrument's keyboard design, spatial positioning, and action were to condition the performer's mechanical approach. An analysis of the impact of these issues on the performer's playing approach has helped to discern the potential attrition effect of a number of finger actions. Moreover, it has

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<sup>1</sup> Bach, *Versuch*, Ch. 1 Fingering, § 19.



aided in an identification of the possible origin of some physical playing aspects which were to characterise later forms to handle the keyboard.

The gradual disappearance of the use of a lower wrist is perhaps one of the clearest examples of the influence the spatial positioning of the instrument had in how performers handled the instrument. Performances away from the organist's church instrument appear to have confronted players with the problems entailed by an ever-changing spatial positioning of the keyboard instrument, a situation which seems to have required an adoption of a variety of positions of the hand, wrist and arm. As a result of this, organists began to recognise in these variations of the standard approach to the key some which facilitated the playing of a number of passages in the music. Among these is precisely the gradual adoption of a higher wrist position which facilitated the use of paired fingerings during the playing of fast passage work. In some regions, however, tradition seems to have led to a re-exploration of the low-wrist approach rather than to its demise. The introduction of continuous fingerings such as 1–2–3–4 (for an ascending right hand), as suggested by Tomás de Santa María, is a shrewd solution to this problem which would allow performers to play ascending and descending scalar movements faster, but without abandoning the use of a low wrist.

The introduction of a high-wrist position appears to have had an effect on the suppleness of the hand and fingers. This was not a minor issue. Türk's account of Wilhelm Friedemann Bach's performance of 'certain runs with [the third finger crossing over the fourth in both hands] with smoothness and an astonishing rapidity' suggests that a number of players attained fast playing speed despite the difficulties entailed by the use of paired fingerings. This seems to be primarily indebted to the use of a high wrist, which allows the tendons to remain in a straight line and, as a result, to operate unobstructed. Recognition of the suppleness and flexibility which the use of this position of the wrist gave to the hand and fingers might have led performers, such as the Bachs, to develop a number of sophisticated approaches to the key while using paired fingerings. Türk's clearly-stated preference for those fingerings in which the turn of the thumb is present suggests that an impression existed that these fingerings would allow playing scalar movements with greater ease

and confidence. This preference seems to issue from his own physical notion of this fingerings: by suggesting that Friedemann's 'hands and fingers were supposed to have had many unique characteristics' he failed to see that these last, which he seems to attribute to the nature of Friedemann's hands, might have been a result of careful observance of the position of the hand and the relaxation of the muscles. Thus, Türk's suggestion that performers could do without paired fingerings not only points to the homogenisation of fingering practices taking place around this period. It also indicates the attention performers were increasingly giving to the mechanical potential of their bodies. That is to say, the initial attention to the turn of the thumb—a highly sophisticated use of the hand and fingers which could only have been implemented after considerable reflection and which, in keyboard playing, is not inherent to the nature of the hand, as paired fingerings are—indicates the presence of a growing attention to the body and its biomechanical possibilities in performance. But while its use becomes essential when playing on the 'difficult keys', its establishment as the fundamental mechanism to be used in the playing of scales reveals the priority given to homogenisation, which facilitated learning, and the increased attention to body's mechanical aspect *per se*.

What nowadays are known as paired fingerings seem to have been one of the simplest natural solutions (i.e. resulting from the biomechanical characteristics of the body) to the need to play a series of more than three ascending or descending contiguous notes in medieval organs provided with the earliest keyboard designs. But how the fingers were to operate on these early keyboards is not the only thing that their use appears to have conditioned. Early keyboard designs (with their large-width keys and gaps among them) might also have contributed to the presence of a constant articulation among the notes: the use of the fingers in keys with these characteristics might have forced performers to release one key before the next could have been lowered. When the clavichord was incorporated into the organist's practical musical life, and considering that the instrument was probably initially handled in the same way as the organ, a detached touch might have been used when playing on it. While more research is required, the evidence suggests that the use of a detached articulation may have become prevalent as a result of the approach developed, as in the case of paired fingerings, on the earliest keyboard designs.

With the appearance of the harpsichord and the clavichord two new technologies of the intellect were introduced which were to reshape performers' approaches to the organ. Diruta's clarification as to how the key of this instrument should be attacked relies heavily on a description of the harpsichord's touch requirements and the musical reasons for it. On the other hand, Santa María warned his readers about the effect of the use of a too strong attack when playing on the clavichord. The comments of these authors thus reveal the existence of a growing awareness of the effect of the body on the instrument's action and, as a result, the quality of the sound emitted. These remarks also document for the first time the presence of clear and distinguishable physico-mechanical approaches involving specific forms to attack the key. In the case of both Diruta and Santa María, an understanding of the workings of the various instruments' actions was essential for their formulation and advocating of differentiated key attacks. This situation thus shows how the introduction and modification of the means of musical communication could affect then modes of thought.

The study of the evidence of wear has helped to uncover a number of differences between some approaches to the key of the clavichord and the harpsichord. Next to an examination of the trace of wear visible in a number of historical instruments, an analysis of the process behind its appearance has allowed me to identify patterns of movement responsible for the shapes exhibited by this physical evidence. Three important conclusions can be initially drawn from this study. First, the presence of a significantly large trace of wear on the front edge of the natural key gives an inkling of the thumb's considerable use during the sixteenth to eighteenth centuries. The mechanical origin of this trace on the action of the thumb has been confirmed through the use of the experimental clavichord. Yet, one must be careful when comparing the abrasive effect of the action of this finger with that of the others: given its biomechanical characteristics, and the fact that the front edge of the natural key is, as a result of its shape, prone to wear in a faster form, the action of the thumb might have produced a proportionally larger amount of wear than that of the other fingers. Despite this situation, the physical evidence visible on this area of the natural key still delivers significant information. For instance, the fact that the thumb was frequently used during the playing of large intervals can be confirmed by the

presence of a more pronounced trace of wear on either side of the front edge. This wear shape results from the thumb's natural tendency to attack the key in a diagonal from when the fingers are separated. Another example of the information that this trace seems to be able to deliver is that in connection with the height of the wrist with respect to the horizontal surface of the key plate. I have suggested that the angle of the trace of wear on the front edge of the key (i.e. that with respect to the surface of the natural plate) could be used to determine that between the lateral side of the thumb in contact with the key and the key's surface. The magnitude of the latter angle can be used to calculate a good estimate of the height of the wrist used by a performer (needless to say, this situation entails a number of difficulties when examining instruments for which no information as to the performer or performers who played on it is available). The position of the wrist could have depended on a number of playing circumstances such as the height of the keyboard and the level of the player's seat. Thus, a thorough analysis of the instrument, which could deliver information as to its spatial layout during performance, might help to shed some light upon a number of circumstances that might have pushed performers to adopt particular positions of the wrist.

Second, the distinctive differences existing between the trace of wear at the centre of the natural plate on plucked instruments and the clavichord seem to be a result of the use of contrasting finger actions. A thorough evaluation of the mechanical implications of the actions of these instruments has assisted in an effort to nuance our understanding of some of the characteristics of the finger action necessary to play on each of these contrivances. As a result of this, it has been possible to demonstrate that close to its rest point, when the quill enters in contact with the string, the harpsichord's key can call for an amount of force larger than that required by the clavichord's at the same level. This circumstance, combined with the possible use by some players of a larger area of the finger cushion (for the purposes of a finer manipulation of the quill), might have contributed to a widening of the trace of wear on the central area of the harpsichord's key plate. This situation has been confirmed through an examination of the appearance of wear on historical instruments and the experimental clavichord. On this last instrument, the trace is frequently not as deep and broad at the centre of the plate as it is on historical harpsichords. This thus seems

to confirm the absence of the amount of force necessary to press down the harpsichord's key, a situation which is compatible with Emanuel Bach's statement that it is at the harpsichord that fingers will gain their strength (*Kraft*).<sup>2</sup>

Emanuel Bach's observation that those who play only the clavichord will experience difficulties when performing on the harpsichord has then to do with the clavichordist's inability to produce the necessary force to activate in an efficient form the instrument's jacks. In other words, by playing only on the clavichord the player's finger not only loses its ability to finely manipulate the quill, but can also fail to find the necessary force to pluck the string. The action of the clavichord offers very little resistance to the finger before the tangent strikes the string. While a certain amount of force is necessary at this point, the finger's ability to resist the reaction of the string without rebounding is by far a more important issue when playing at this instrument. At the moment at which the tangent touches the string the force applied by the finger and the string's reaction to this force will conspire to create a pressure stress on the area in which the finger touches the plate. This situation will contribute to the wearing-out process of the plate. The differences in depth between the traces of wear present on historical plucked instruments and clavichords suggest that this attrition process is of a less aggressive nature than that which takes place when the finger manipulated the harpsichord key. Hence, the amount of force required by the clavichord's action appears to be proportionally smaller than that necessary at the harpsichord.

Third, the reconstruction proposed here of Bach's physico-mechanical approach has assisted in an attempt to identify a number of specific mechanical implications of his touch. One of the particular elements of this reconstruction is the presence and critical use of a withdrawing movement of the finger in the direction of the palm of the hand. This movement, I have argued, exists in two forms: a natural one which is observed when the finger, once the pressure this exercises on the key is released, is relaxed. The length that the finger travels in the direction of the palm will to a great extent depend on the height of the wrist and the suppleness of the hand and fingers.

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<sup>2</sup> It remains to be explored if Emanuel Bach also considered here the use of a coupled double-manual harpsichord.

The withdrawing of the finger also takes place when the performer forces the finger to move in the direction of the palm. These two movements were present during the playing of the experimental clavichord. A comparison of the traces of wear obtained on this instrument with those present on late seventeenth- and eighteenth-century clavichords suggested that the two forms of the withdrawing of the finger contributed in great measure to the shaping of the trace of wear as it is now visible on these instruments. While the evidence available at present is insufficient, the presence of the characteristic wear trace associated to the use of the withdrawing of the finger in a 1543 clavichord by Domenico Pisaurensis (GMI, Leipzig, no. 1) suggests that this use of the finger, mentioned by Quantz and Forkel in relation to J.S. Bach, was probably to be found already in the practice of some sixteenth-century performers.

The examination of the sources which served to inform the reconstruction of Bach's approach also provided valuable information regarding the situations in which the gliding-off movement of the finger seems to have been found in Bach's playing. A side-by-side reading of writings by Forkel, Quantz and Emanuel Bach was thus not only to help to advance the existence of the two forms of the movement described in the last paragraph. A thorough analysis has helped to suggest that Bach might have used a natural or forced form of the gliding-off movement depending on the musical requirements of the passage to be performed.

While more limited in its scope, an examination of written and iconographical sources aided in an attempt to explore how, as a result of the clavichord's influence as a technology of the intellect, the performer appears to have participated in a redesign of the keyboard of the medieval organ. The introduction of intersected keys on the organ seems to have resulted from the organist's encounter with this type of keyboard on the chromatic clavichord. This introduction thus speaks of the strong impression a number of characteristics of this keyboard design made on the organist's mind. What is more, the presence of an intersected-key keyboard on the organ was also to broaden the impact of this technology on the performer's modes of thought since this modified organ—as an altered means of communication—was to open up new ways of musical thought and manners of performance.

In spite of the impact the new keyboard design of the organ was probably to have on the player's handling of the key, it is significant that the use of some physico-mechanical approaches such as paired fingerings were preserved. I have suggested that these fingerings seem to have originated on the handling of keyboards displaying broad keys. Thus, the use of paired fingerings on instruments with significantly narrower keys suggests that tradition played a major role in their preservation—i.e. pupils were taught not to question received knowledge. But in spite of the fact that the principle of a long finger crossing over a short one was not abandoned, it was to undergo subtle refinements which can be gleaned through a perusal of a number of treatises discussing their use and implications.

Perhaps not as evident in its impact on the overall appearance of the keyboard, the presence of trapezoidal-shaped chromatic blocks appears to indicate the existence of at least one sophisticated playing approach. J.S. Bach is reported to have required the chromatic blocks to be 'a little narrower at the top than at the bottom'.<sup>3</sup> I have suggested that among the possible reasons behind this request is that a block in this shape would allow the finger to remain in contact with one of its lateral surfaces during the release of the key and the finger's movement in the direction of the neighbouring natural key. This resource would have helped to introduce, if necessary, a shorter articulation between a note played on the raised chromatic key and the following natural one as the release of the first could thus have been considerably delayed.

Through a joint examination of historical texts, iconography and instruments it has also been possible to glimpse the role played by socio-cultural issues in modifications of the instrument's organology which might have helped to characterise manners of performance. The small-width key that can be observed in a number of French harpsichords seems to be a case in point. It is during the sixteenth and seventeenth centuries that the movements of the body were gradually restrained. Sixteenth-century court regulations were to have an impact on the practice of a number of activities and the manners and behaviour to be observed while involved in them. Dancing, horse riding and fencing became gradually regulated, something

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<sup>3</sup> David, Mendel, and Wolff, *NBR*, no. 358c, 365.

which was to help to impose a control on daily routine and the movements of the body. Abrupt and uncontrolled movements thus gave place to reduced and coordinated ones. This situation calls for a re-evaluation of the manner of performance of musicians such as Chambonnières, an accomplished dancer himself. That is to say, a thorough understanding of how he used his body at the instrument has necessarily to consider that his body, and that of his listeners, was one shaped by socio-political forces aimed to ensure a control of courtiers. The banishing of abrupt and large movements, something which still reverberates in eighteenth-century recommendations to avoid using unnecessary movements while playing, might have prompted performers to require from builders the inclusion of smaller keys. Keyboards with a shorter *Stichmaß* would thus have facilitated the use of smaller movements of the body. Moreover, given the proximity of the fingers, and taking into account the impact on suppleness that this arrangement of the keys might have had, performance of ornaments might have been instigated and facilitated. An obsession in a number of German courts for all things French seems to have led some builders, such as Mietke, to build instruments displaying narrower keys. But while a degree of the political control of the body observed in French courts might have been found in their German counterparts, it would difficult at this point to determine if Bach's possible approval of these instruments was a result of an ideological assimilation, or a matter of physico-mechanical convenience. Although he was to enter in contact with a number of French practices and individuals, it is most probable that his use of small movements in playing was a result of an awareness of their effect in playing achieved during his training as an organist and through personal inquiry.

Socio-cultural issues characterised manners of performance in ways that would require another study to examine them thoroughly. However, in this work I have attempted to illustrate some of the forms in which these issues shaped mechanical approaches, thus allowing players to perform in a meaningful manner. Various organological changes experienced by the medieval organ—prompted by biomechanical, musical, and practical necessities—are, next to the influence of complex socio-cultural issues, behind the conformation of characteristic techno-mechanical approaches. A number of physico-mechanical approaches were in some



cases to gain wide acceptance. However, one must keep in mind that behind their outward mechanical appearance these were nuanced by historical socio-cultural needs. These needs considerably affect the complex process behind the conformation of the techno-mechanical approach which serves to deliver musical meaning. Trying to view the activity of the performer's body at the instrument detached from its socio-cultural component can thus hinder our ability to understand in depth how the body of the performer helped to deliver musical meaning.

Emanuel Bach emphasises on a number of occasions the importance for a good performance of an awareness of the contents of a composition, something which is to be acquired through listening and practice. This suggests that the mechanical elements of playing he discusses should be probably understood as having been an aspect of the broader techno-mechanical approach. This approach is characterised by a mechanical component of playing being brought forth from an awareness of the contents of the composition. But the way in which the larger bodily attitude has been fashioned and regulated as a result of the performer's existence within a socio-cultural reality will also help to nuance the player's techno-mechanical approach. Social and religious conditions prevalent in the Lutheran reality in which J.S. Bach lived and worked seem to have had a considerable impact in his manner of performance. In this study, the place of singing in Bach's society has been taken as a departure point for an exploration of how Bach seems to have understood the role of instrumental performance within this reality. An examination of the implications of the term *cantabile* in the title page of the *Auffrichtige Anleitung* served not only to recognise the role of singing in the establishment of the Lutheran faith, but to reveal how singing was to shape cultural understanding of music performance. I have suggested that Bach might have used the term *cantabile* to express his view that performances of instrumental music, as singing, helped to move players and listeners to devotion. This belief, which seems to be confirmed by the presence of the title page of the *Auffrichtige Anleitung* in copies of the original manuscript made by his pupils, would indicate that for him, as perhaps for a large number of Lutheran musicians, musical performance was a devotional act *per se*. The playing of an instrument can thus be an activity in which a strong element of motivation lies behind the physical activity of the performer. The consequence of this notion is that

the mechanical action behind the physical trace which can be found on historical instruments would need to be considered as having a socio-cultural component. While this cannot be glimpsed from an analysis of the physical trace of wear or the mechanical action produced by it, it has been decisive in how a performer used his or her body in performance and, therefore, in how the surface of the keys has been affected.

An exploration of the implications of organology in the development of particular approaches to the instrument entails significant problems. Despite this, it is hoped that this study will encourage further research on the impact of a technology of the intellect, represented by the musical instrument, in the shaping of manners of performance. In this form, we might be able to nuance our understanding of how performers of the past mingled with their instrument to deliver a meaningful performance.

# Appendix 1: The use of wear evidence in a study of mechanical approaches to the early key

The absence of instruments from a particular historical period forces researchers to speculate from the available written and iconographical evidence. At times, the evidence allows us to gain a better insight into the organology of non-extant instruments belonging to particular historical periods. However, it can also lead to problematic considerations. One example of this situation are the difficulties posed by the organ depicted by Jan van Eyck in the Ghent altarpiece, a representation which has been considered by a number of scholars in the past as that of a real instrument. Some organological incongruities found after an examination of the organ's depiction have led a number of researchers (among them, Edwin Ripin)<sup>1</sup> to put this hypothesis into question. This situation calls then for caution when examining other iconographical sources.

Despite this problem, iconography is still a potential source of information on some organological aspects of historical instruments. The study of iconographical sources, next to careful analysis of extant instruments, historical descriptions of these artefacts, and performance practices, may help to reconstruct some aspects of the instrument's past organologies. It could also help to facilitate an insight into the possible effects of these last in the actions of the performer's body, the conformation of particular music idioms, and the listener's experience of music. Furthermore, as I have argued in chapter 1, the topology of some of the earliest designs of the organ keyboard might be behind the origin of a number of mechanical practices which were to prevail for centuries as the basic approach to the keyboard. Thus, a study of the

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<sup>1</sup> See Ripin, "The Norrlanda Organ and the Ghent Altarpiece," 194.

characteristics of non-preserved instruments might help to enrich our understanding of the possible origin of these practices, their relation to the instrument's organology, their impact on performance, and how all these issues stimulated performers and builders to further modify the instrument's organology.

The earliest approaches to a medieval organ incorporating a keyboard might, to some extent, have had their origin on those previously used in instruments with sliders. In these last instruments performers had to pull out the slider,<sup>2</sup> an action which most probably would have required the use of the thumb as this finger is necessary when a firm gripping action is required.<sup>3</sup> Given the natural mobility of the thumb, the likely slow speed of the melodies played on the slider organ (which, most probably, were also those initially performed on the keyed instrument), and, perhaps above all, the position of the thumb when the hand, carried by the arm, is raised,<sup>4</sup> this finger was probably to play a central role in the manipulation of the early-keyed organ. A lack of detailed technical information on the precise weight characteristics of the organ key could lead us to think that a specific—though perhaps impractical—way to operate the key was used (e.g. the fingers were used to play a far too heavy key<sup>5</sup>). For this reason, let us briefly examine a number of examples that seem to speak for the use of the thumb in the handling of the early keyed instrument.

A thirteenth-century Vignette in manuscript of the *Cantigas de Santa Maria* shows a seated performer holding a small portative organ in front of his chest (see plate A. 1.1).

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<sup>2</sup> See, for example, the representation of an organ player found in the *Pommersfelden Psalter*. The image can be found in Perrot, *The Organ*, plate XXV, 2.

<sup>3</sup> This is a result of the thumb's biomechanical characteristics which allow it to oppose other fingers, move with ease towards them, and apply the force necessary to hold an object.

<sup>4</sup> In a person with a sound body posture the palm of the hand will point to the side of the body when the arm is kept relaxed and left to hang while standing. Under these circumstances the surface of the thumb's nail will be in a similar plane to that of the sternum (breastbone). If one raises the arms in the direction of the front of the body, and at the level of the sternum, the surface of thumb's nail will point upwards. If this natural movement was the one used to reach the slider, the thumb would have gripped it on the upper surface. See below for the possible implications of this biomechanical characteristic of the body when playing on the keyed organ.

<sup>5</sup> For instance, in the earliest manuscript of Hero's *Pneumatica* (c.1250, *Venice ms. Marcianus 516*) the schematic depiction of the key's mechanics does not help to establish if the key's action was light enough to be operated by single fingers.



**Plate A.1.1 Organ player, *Cantigas de Santa Maria*, thirteenth-century manuscript (Codex Escorial b.I.2)**

The player is using the left hand to operate the bellows while with the right-hand thumb he presses the keys (or buttons). The thumb seems to be the only finger in contact with the keys as the rest of them are used to grab the instrument from below. Although there is a stripe around the performer's neck, probably intended to help to keep the instrument at the level of the chest, the right hand below the instrument was probably necessary to stabilize it.

In an image found in the *Glossarium Salomonis* King Salomon is depicted playing an organ. Here, one can clearly see that it is the thumb the finger used to press down the rather long organ key. In this representation it is also possible to observe that the rest of the performer's fingers remain unused (see plate A.1.2).



**Plate A.1.2 King David at the organ, Glossarium Salomonis, München Staatsbibliothek**

If the thumb was the only finger used when playing on this instrument its action would have left a distinctive trace of wear on the surface of the key, one which may have been very similar in its appearance throughout the whole compass of the keyboard.

Although further research is needed, the trace of wear that can be observed in the keys of the organ of Norrlanda suggests that a similar approach to the one just described above appears also to have been in use by performers playing on this instrument. The keys on this organ show a trace of wear in the front section of the natural key. The area in the key occupied by this trace, as well as its shape, is surprisingly similar throughout the keyboard (see plate A 1.3).



**Plate A.1.3 Traces of wear on the surface of the natural keys, Norrlanda organ, National Historical Museum, Stockholm**

Both the shape of the trace and its uniformity suggest that the keys were operated by using the thumb in this area of the key. This idea is further supported by the presence of wear on the lower side of the front of the key, precisely below the place where the thumb would have been positioned (see plate A.1.4).



**Plate A.1.4 Traces of wear on the underside of the natural key, Norrlanda organ; the shiny spots are those affected by wear**

As I will attempt to show, the presence of this trace seems to suggest that some performers were to hold the key with the second finger and the thumb while pressing it down.

If the thumb and the second finger were to hold the key the second finger would have had to remain under the keylever.<sup>6</sup> The second finger would then have tended to adopt either a perpendicular position to the thumb and the key (i.e. the intermediate phalanx would run from right to left), or an arrow-like one (i.e. the proximal interphalangeal joint, the one between the proximal and the intermediate phalanxes, would tend to point towards the centre of the instrument) (see plate A.1.5).

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<sup>6</sup> See above, note 4.





**Plate A.1.5 Norrlanda organ keyboard; holding the key using the thumb and the second finger**

From an observational point of view, the wear present in the lower part of the Norrlanda organ keys seems to correspond to a positioning of the second finger in either of the two ways just described. Thus, when considering this evidence next to the rather uniform trace above the natural key plates, which suggests a use of the thumb, one could argue that some performers might have lowered the key by holding it using both the thumb and the second finger.

Recent infrared reflectography and X-radiography images of the Ghent altarpiece have helped to unearth further details concerning both the early design of the keyboard of the organ and the position of the hands of the player.<sup>7</sup> One of the most striking pieces of information revealed by the X-radiography has to do with the shape of the original keys. Now it is clear that these were not only significantly longer than those visible in the last version of the painting, but that their shape closely resembles that of the key in the Norrlanda organ. This evidence calls for a re-evaluation of a

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<sup>7</sup> Ripin had at his disposal infrared macrophotography images. While these reveal important details about the condition of the hands and the keyboard before repainting, a number of other significant details, such as the precise length of the original natural key, remained hidden to him.

number of details concerning the instrument's organology and the performer's body in performance.<sup>8</sup> In the latter's case, it is now possible to confirm that a low wrist was already in use before the intersected-key keyboard design made its appearance. More important here is that, though the shape and length of the key this organ originally displayed is similar to that present in the Norrlanda instrument, the evidence suggests that in the first version the playing approach employed by the performer involved the use of at least the three longest fingers.<sup>9</sup>

The dating of the Norrlanda organ is problematic. However, it is perhaps safe to assume that it was built during the last decades of the fourteenth century. Thus, the presence in the Ghent altarpiece of a keyboard design similar to that in the Norrlanda organ suggests that instruments displaying this keyboard were perhaps still been built during the early years of the fifteenth century. Moreover, the original depiction of the hands of the organist suggests that an approach in which the long fingers were used probably originated at some point during the second half of the fourteenth century. Hence, this approach might have been developed in instruments displaying a Norrlanda-type keyboard design. A full exploration of the reasons behind this change will require another study. However, some hypotheses have been advanced in chapter 1.

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<sup>8</sup> Among the details revealed by the new images are changes in the angle of the surface of the keys with respect to the backboard, and the shape and length of the keys. Another significant aspect of the original keyboard, which is not clearly visible in the infrared macrophotography image, is that the natural keys were wider than those now visible. Extra keys appear then to have been added, something which would have affected the correspondence (if there was one at all) between the number of keys and pipes. Thus, both the atypical characteristics of the keyboard in its present state and the repainting of the fingers call for a re-exploration of the image which should initially consider the relation between the hand and the keyboard before the repainting was done.

<sup>9</sup> The X-radiography suggests that the right-hand thumb was not originally present in the depiction. On the other hand, the position of the fifth finger of the left hand does not confirm or preclude its use. See the X-radiography in chapter 1, plate 1.5.

# Appendix 2: The Tonal Matrix of Victor Gama

The National Museum of Scotland houses four instruments designed and built by the Portuguese musician Victor Gama. These are currently displayed in the permanent galleries. Among these there is the Tonal Matrix. It consists of two curved vertical wood panels, divided in two sections, each presenting three rows of five tuned metal tongues (see plate A.2.1).



**Plate A.2.1 Tonal Matrix, Victor Gama**

The horizontal distance between these tongues is around ten centimetres. The tendency, observed when a group of musicians approached the instrument, is to activate the tongues with the second finger of each hand. However, visitors of the museum also tend to use the thumb to press down the tongues (see plates A.2.2 and A.2.3).



**Plate A.2.2 Victor Gama playing the Tonal Matrix**



**Plate A.2.3 Tonal Matrix played using the thumb**

This instrument thus helps us to visualise a number of playing approaches resulting from the particular distribution of the tongues. First, when the speed of the notes is not too high a player would tend to use only one finger to play all of them. Second,

when one tries to use a sequence of long fingers (e.g. 2–3–4) in ‘keys’ separated this much, the fingers would be overstretched. Hence, it becomes clear that playing with only one finger on instruments showing a similar keyboard design might have been the most convenient solution available.

A solution which considerably facilitates the playing of ascending or descending passages involves the sequential use of two long fingers (e.g. right hand, ascending, 3–4–3–4). This approach probably resulted from an exploration of the keyboard encouraged by a need to play faster sequences of notes in early keyboard designs such as that present in the Norrlanda organ (see plate A.2.4).



**Plate A.2.4 Possible use of paired fingerings in the Norrlanda organ**

While more research is necessary, it is important to point out that, as in the case of the use of either the thumb or the second finger in the playing of slow note sequences, the use of ‘paired fingerings’ seems to be part of a natural response of the body. Children and adults with no experience at the keyboard frequently adopt this approach when realising that not enough fingers are available to continue playing an ascending or descending scale.

# Appendix 3: The experimental clavichord

In order to facilitate an insight into the process that sees the appearance of wear on the surfaces of the key tops a copy of a historical clavichord was prepared to receive a set of high-wear-rate-material experimental tops. In this case, the material with a high wear rate is that which, given its mechanical characteristics, will reveal the effects of an abrasion process in a faster form than wood, ivory, or bone. The technical information related to this instrument and the experimental tops is given below.

A copy by John Raymond of a 1700 double-fretted clavichord by Johann Jacob Donat was adapted for the purposes of an experiment related to the production of wear.<sup>1</sup> The instrument received a new keyboard which was expressly built for these tests. Once the levers were levelled, the balance points adjusted, and the position of the tangents rectified the bare-wood key levers received a set of tops made of a plaster mixture developed by David Hugo.<sup>2</sup> The composition of the plaster is as follows:

500 g. Silica flour (kaolin)

100 g. Crystalcal R plaster

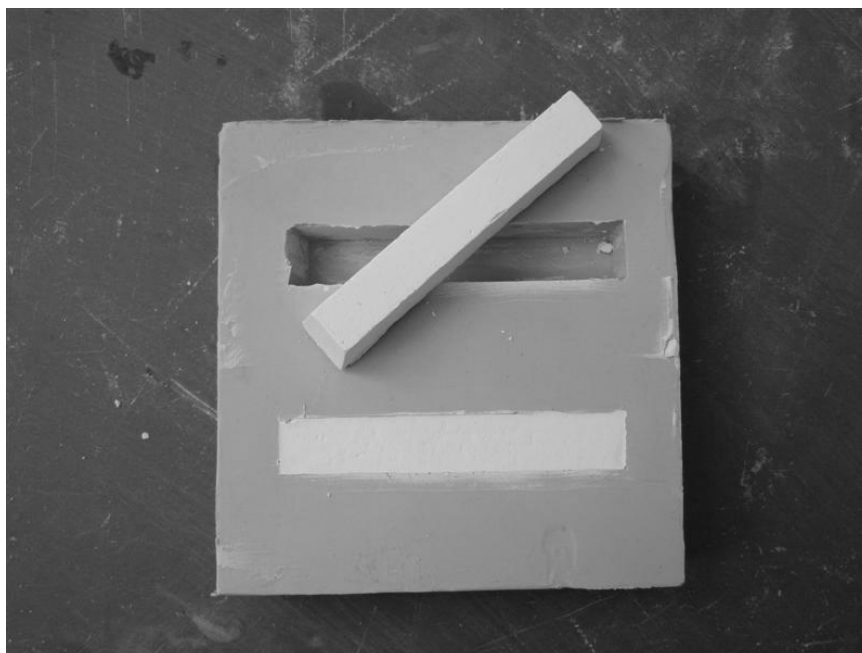
250 ml. water

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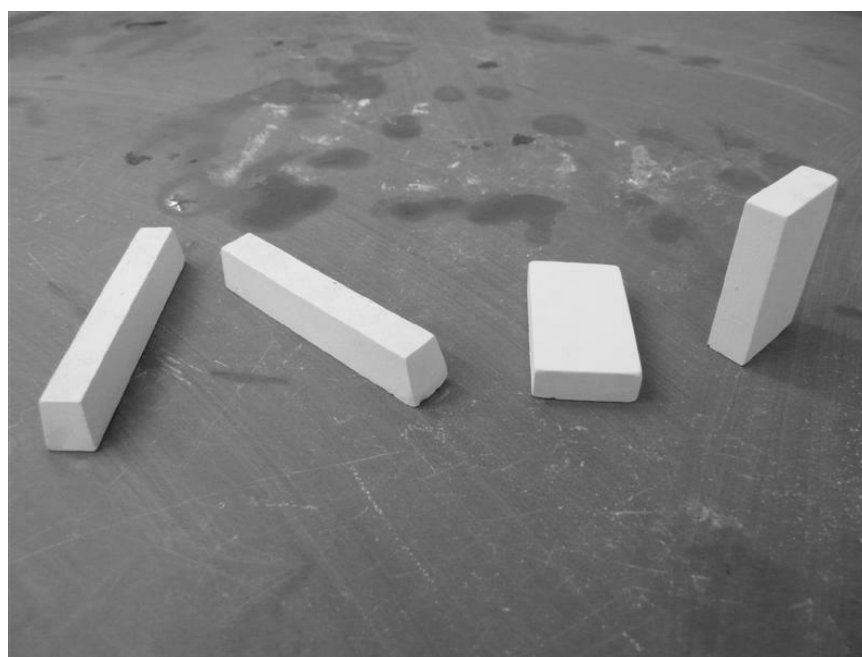
<sup>1</sup> Built by John Raymond, Assistant curator, Edinburgh University Collection of Historic Musical Instruments, University of Edinburgh. The original instrument, which was built in 1700, is housed at the Grassi Museum für Musikinstrumente der Universität Leipzig (Leipzig), cat. no. 12. The last three notes (*c'''-c#'''-d'''*) are triple-fretted. Unfretted notes: *a, e', b', e'', b''*. Further technical information on this instrument can be found in Boalch, *Makers of the Harpsichord and Clavichord*, 297–298; and Henkel, *Clavichorde*, 37–38. John Raymond also built the new keyboard used during the tests. I am grateful to John Raymond for having prepared the new keyboard, and for allowing me to use his instrument during the tests.

<sup>2</sup> Model making room assistant, Edinburgh College of Art. I would like to express my thanks to David Hugo for all the support and technical advice received during the preparation of the experimental tops.

This mixture was poured into silicone rubber moulds. After approximately one hour the material set and the raw top was retrieved from the mould in order to let it dry for a number of days. It was then filed to size and glued to the key lever.



**Plate A.3.1 Raw key tops and mould**



**Plate A.3.2 Raw key tops**

The particular proportions found on the plaster mixture used are those belonging to one of the six different test samples originally produced to evaluate their resistance to wear. Each of these samples was made by using a different proportion of the same basic materials. The selected sample was chosen as it showed a wear rate which was considered would allow an observation of a trace of wear after a short playing time. The test made in order to determine its resistance to wear consisted in rubbing repeatedly the flat side of the sample with a finger—in a similar form as this would be done during keyboard playing, but applying some extra pressure. The length of the rubbed area amounted to around 2 cm. The movement was repeated 250 times. After this, the selected sample presented a visible trace of wear. As a result to their resistance to wear a number of samples were not affected at all by the action of the finger.

Two sets of tops were originally prepared.<sup>3</sup> The first set was used in order to test the regularity of the action, and to provide the performer with an opportunity to play and adapt to the new playing surface. At the same time, this preliminary test helped to confirm that the wear rate of the material would allow an observation of a clear trace of wear after the complete set of J.S. Bach's Inventions BWV 772–786 would have been played through three times. The wear that appeared on this set of tops was photographically documented. However, this set of tops was not used during the later analysis of the evidence of wear.

Once the first set of experimental tops had been removed, the second was immediately glued to the key levers. This set was carefully levelled and filed. The final measurements of the tops are found below (see table A.3.1).

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<sup>3</sup> I intended to produce a third set of tops. This was not possible since the workshop ran out of the necessary materials. The new batches sent to the Edinburgh College of Art did not provide the same characteristics of wear resistance. For this reason, caution has to be exercised as it is possible that a new attempt to produce key tops using the proportions given above will not deliver the same wear resistance and, thus, similar results to those presented in this thesis.



Key top (c')	length	width	thickness	Special characteristics
Natural head	3.6 cm	2.12 cm	62 mm	Three decorative lines were scored in the top. The distance between the line closer to the front edge and the division between the head and the tail is 4 mm.
Natural tail	3.85 cm	1.45 cm	62 mm	The length of the tails was kept short since no action of the finger was expected to occur at its back.
Chromatic block (c#)	6.45 cm	89 mm (top) 100 mm (bottom)	Height 10.5 mm	In contrast to the block in the original instrument, this one is not tapered towards the end. The model for this block is that present in an anonymous clavichord at St Cecilia, Edinburgh, cat. no. 4487.

Table A.3.1 Experimental tops' measurements

Although every effort was made to level the surface of all the key levers before the tops were glued, in some cases it was necessary to reduce the thickness of the top in order to create an even surface. This reduction did not play a significant role in the final weight of the key.

# Appendix 4: The role of singing in the Lutheran religion

Sixteenth-century European societies experienced in different ways the impact of the religious turmoil caused by the reform movement taking place in the German lands. The population of these territories was to witness and participate in changes which, in some cases, greatly affected the relationship between church and society. One of the most immediate and influential of these changes occurred within the reformed religious service of the Lutheran confession, namely the introduction of congregational singing. This move by the new authorities, which was to differentiate their service from those of Catholic practice and that of other reformed churches, was to help to create a unique cultural frame which would become the cradle of a distinguished musical tradition.

Singing was an element of the popular culture which had already occupied a prominent place within medieval society. It was found at the most diverse places where pre-industrial society people gathered, e.g. the fields, courts, festivals, taverns, markets, and houses.<sup>1</sup> Congregational singing became for many one of the most agreeable parts of the service.<sup>2</sup> The decision to include the believer in an activity previously reserved to monks, trained singers, and choirs seems to have been taken in order to reshape and increase the influence of the Church on the individual and in the society to which it belonged.<sup>3</sup>

The leaders of the new confession might have appealed to the power of music as a cohesive element between Church and society. The practice of singing during the service became for them an expression of commitment to their religion. But the

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<sup>1</sup> See the testimony of the Carmelite Thomas à Jesu about the popularity of the hymns, in Andrew Pettegree, *Reformation and the Culture of Persuasion* (Cambridge: Cambridge University Press, 2005), 52. Christopher Boyd Brown criticizes the approach of some social historians which appear to pay attention only to the use of hymns in Lutheran churches and schools, neglecting the study of their use in private circumstances. See Christopher Brown, *Singing the Gospel: Lutheran Hymns and the Success of the Reformation* (Cambridge MA: Harvard University Press, 2005), 9.

<sup>2</sup> Pettegree, *Reformation and the Culture of Persuasion*, 40.

<sup>3</sup> See Brown, *Singing the Gospel*, 8.

sphere of influence of church hymns and new chorales was not to become limited to the space of the church. Through the presence of practical music at the reformers' schools, where children were introduced to this music, and the adoption of some elements of popular songs in the reformers' newly composed hymns and chorales (many of them in the vernacular),<sup>4</sup> religious music permeated other layers of the social fabric away from those two institutions, interspersed with traditional melodies.<sup>5</sup> In this form one of Luther's wishes succeeded, namely, that the Word of God would live among people.

The presence of singing in the believer's daily life initially came to strengthen and support the confessional conversion. The practice of singing also introduced those participating in the new Lutheran religion into the language of the confession. Thus, music merged not only into the routine of people, becoming in this form firmly rooted in their perception as a manifestation of their faith. It also became intrinsically united to the confessional language shared by this society, hindering a purely intellectual appreciation of the doctrine and helping to open the way for the appropriation of the Lutheran religious reality. In all, the reformers' attitude towards singing helped to establish it as an act entirely associated to the confession and, as a consequence, analogous to it. Singing became then, together with activities such as teaching and learning,<sup>6</sup> an element of the language of worship.<sup>7</sup>

At the end of the seventeenth and the beginning of the eighteenth centuries some authors emphasise the relation of music-making to the praise and the glory of God,

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<sup>4</sup> For a recent reinterpretation on the influence of popular melodies in Lutheran music, see Robin A. Leaver, *Luther's Liturgical Music: Principles and Implications* (Grand Rapids, Michigan: Wm. B. Eerdmans Publishing Co., 2007), 12–18.

<sup>5</sup> Thomas à Jesu 'marvelled at how securely Luther's hymns had planted Lutheranism in Germany, pouring forth from Wittenberg to fill the German houses, workplaces, markets, streets, and fields'. See Brown, *Singing the Gospel*, 1. Luther's aim is clearly stated in his preface to the *Geistliches Gesangbüchlein* (1524): '...I am willing to prepare spiritual songs in order that the Word of God may be conserved among the people through singing also'; quoted in Buszin, "Luther on Music," 87. The popularisation of Luther's hymns is attested by the large number—more than two thousand—of printed hymn editions during the sixteenth century. See Brown, *Singing the Gospel*, 5; Pettegree, *Reformation and the Culture of Persuasion*, 45–46.

<sup>6</sup> Leaver, *Luther's Liturgical Music*, 120–121 and 304.

<sup>7</sup> Needless to say, the response to the view that music played a role in the expression of devotion and worship was to vary depending on the brand of Lutheranism.

something that Luther himself had acknowledged in his own writings.<sup>8</sup> This might partly reveal itself as a symptom of the influence of secular music at various levels of society. The growing presence and status of music in secular society affected the conditions prevailing at the church and school musical establishments, a circumstance not unanimously greeted in friendly terms.<sup>9</sup> At the same time it prompted some authors to direct themselves to the court and a bourgeois emerging market through treatises which do not fail to emphasise the aims of music and its relation to God.<sup>10</sup> Nevertheless, the place of music at church deteriorated. Music began gaining autonomy as an aesthetically-based art losing in this form its influential role in church and school as a vehicle for the Word of God.<sup>11</sup>

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<sup>8</sup> See, for example, the definitions of Daniel Speer (1697) and Martin Heinrich Fuhrmann (1706); quoted in Butt, *Music Education*, 36–37. Treatises like Launentius Ribovius's (1638) and an anonymous from 1752 contain Luther's comments on music. See *ibid.* 64.

<sup>9</sup> Johann Kuhnau is one who complains about ex-pupils and university students being involved in secular performances. See *ibid.* 22–23. On Kuhnau's attitude towards theatrical music, see *ibid.* 29. On the objections to the presence in church music of the newest operatic elements, see Butt, "Bach's Metaphysics of Music," 49.

<sup>10</sup> Two examples are those treatises by Johann Walther and Friederich Erhardt Niedt. See Johann Walther, *Praecepta Der Musicalischen Composition* (1708), ed. Peter Benary (Leipzig: Breitkopf & Härtel, 1955), *Erste Abhandlung*, section 1, § I (f), 14; and Friederich Erhardt Niedt, *The Musical Guide*, trans. and ed. Pamela Lee Poulin and Irmgard C. Taylor (Oxford: Clarendon Press, 1989), Part I, Ch. II, 28. Other eighteenth-century treatises emphasising music's place next to that of theology are J.P. Eisel (1738) and J.F. Maier's (1732/1741). See Butt, *Music Education*, 67.

<sup>11</sup> On the influence of music on the affects, and music's departure from its aim as a liturgical element, see *ibid.* 41–46, and 50–51.

# **Appendix 5: Information related to the trace of wear produced on the experimental clavichord**

This appendix contains photographic material documenting the trace of wear produced on the experimental clavichord. Tables containing information related to the time allotted to each of the Inventions and the presence of individual notes (but not pitches) within individual pieces are also included.

## **Documentation of wear evidence**

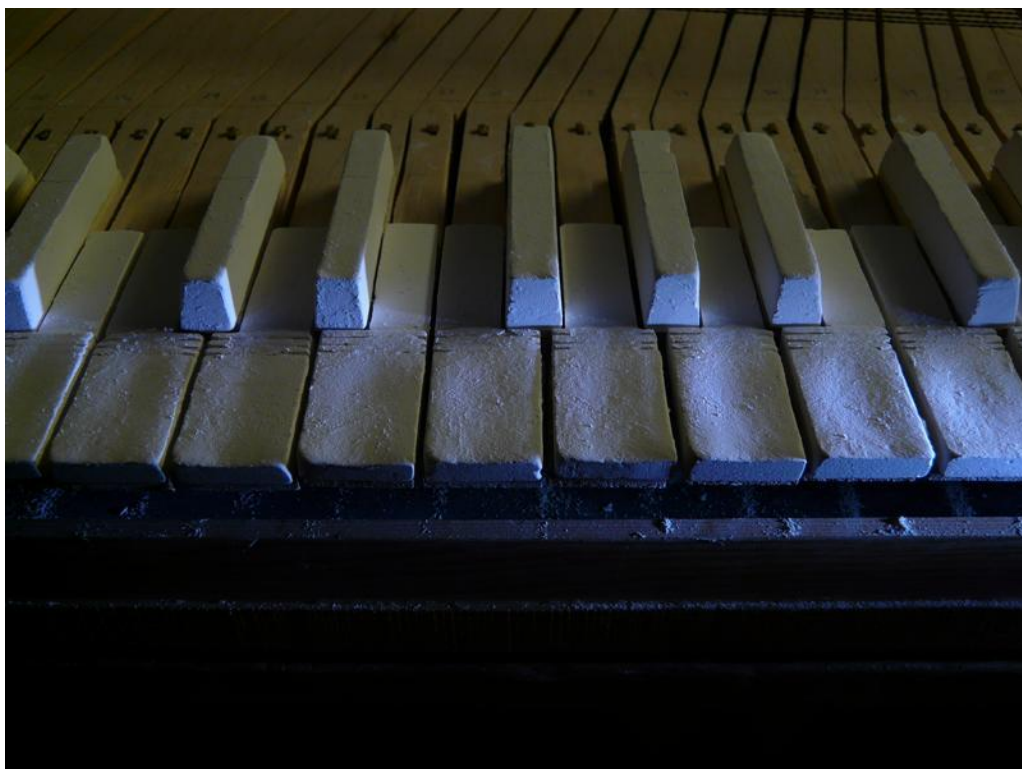
The approach above proposed produced the trace on the tops shown in the photographs below (central octave,  $c'-h'$ ). The photographic material was taken on the date, and after having played the piece, indicated on the caption. For information regarding dates and playing times, see below, table A.5.1.



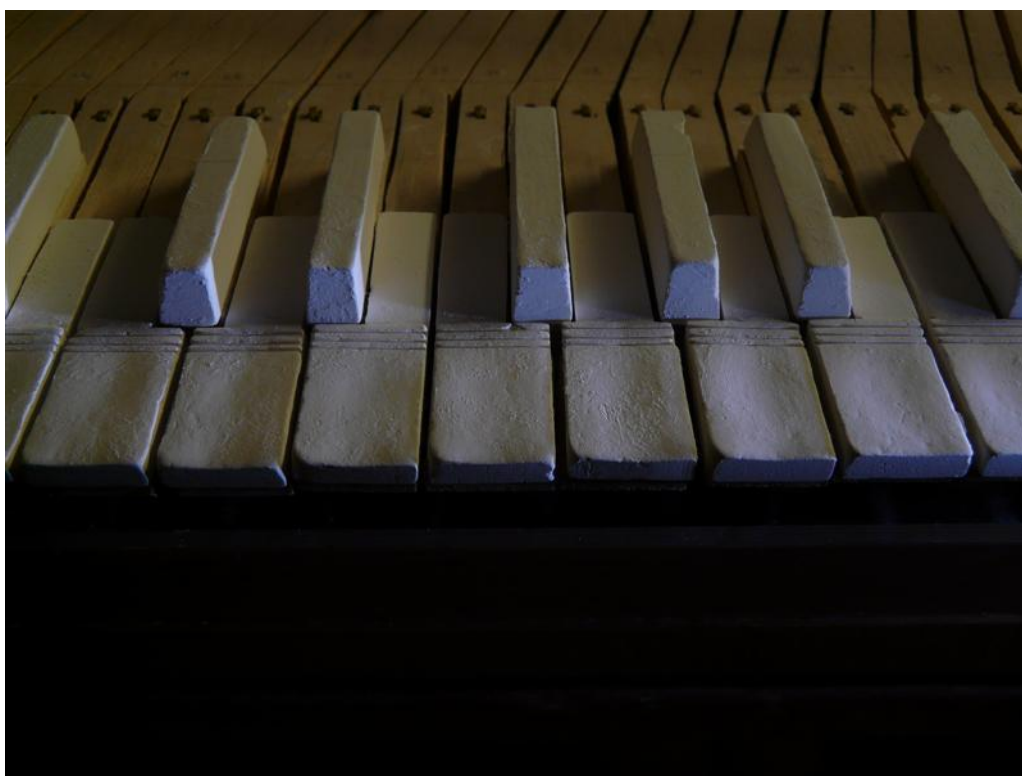
**Plate A.5.1 Trace of wear after E minor Invention (17/10/2011)**



**Plate A.5.2 Trace of wear after G major Invention (18/10/2011)**

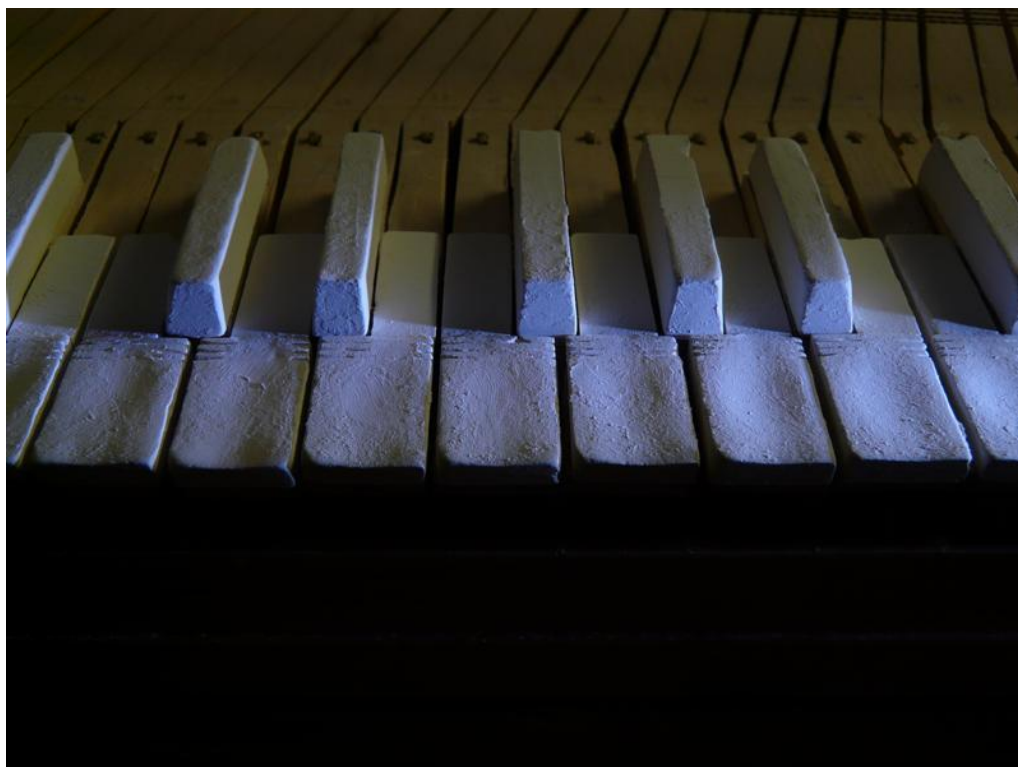


**Plate A.5.3 Trace of wear after B minor Invention (18/10/2011)**

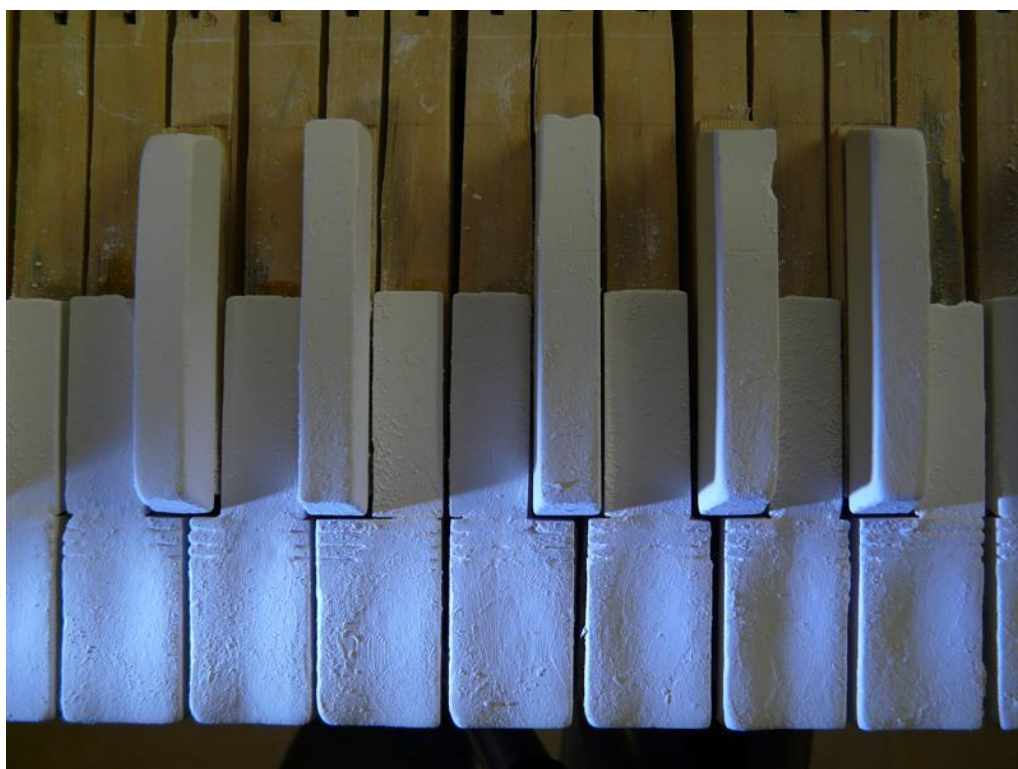


**Plate A.5.4 Trace of wear after B flat major Invention (19/10/2011)**





**Plate A.5.5 Trace of wear after F minor Invention (21/10/2011)**



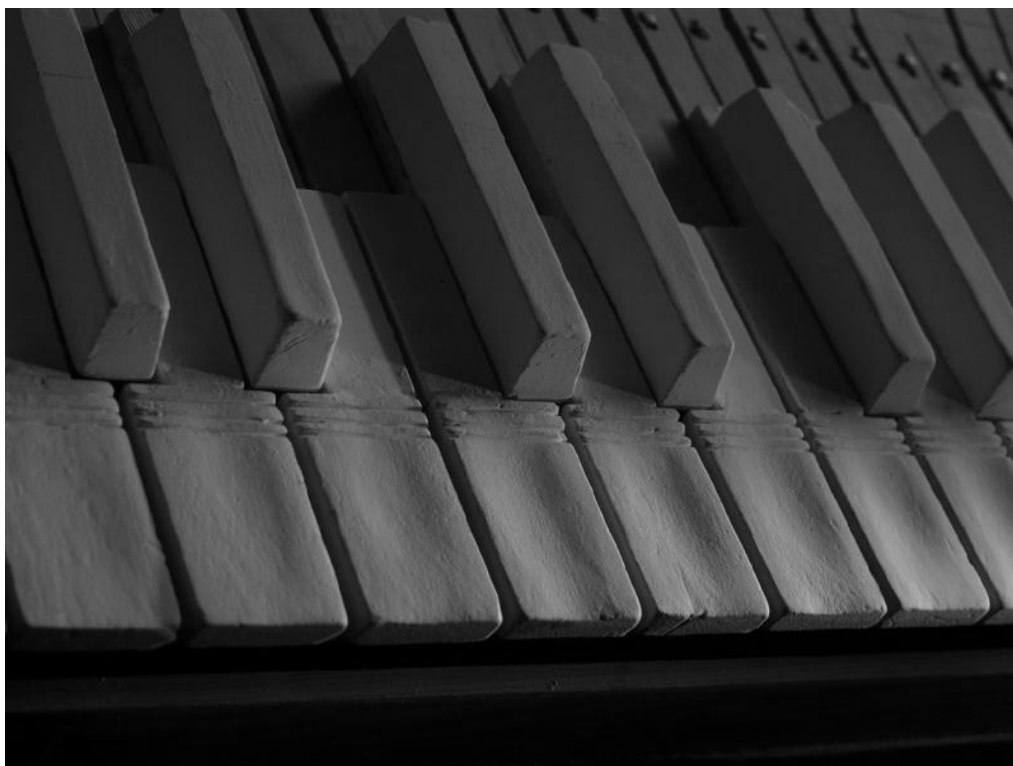
**Plate A.5.6 Trace of wear after C minor Invention (24/10/2011)**



**Wear trace after the C minor Invention: complete keyboard**



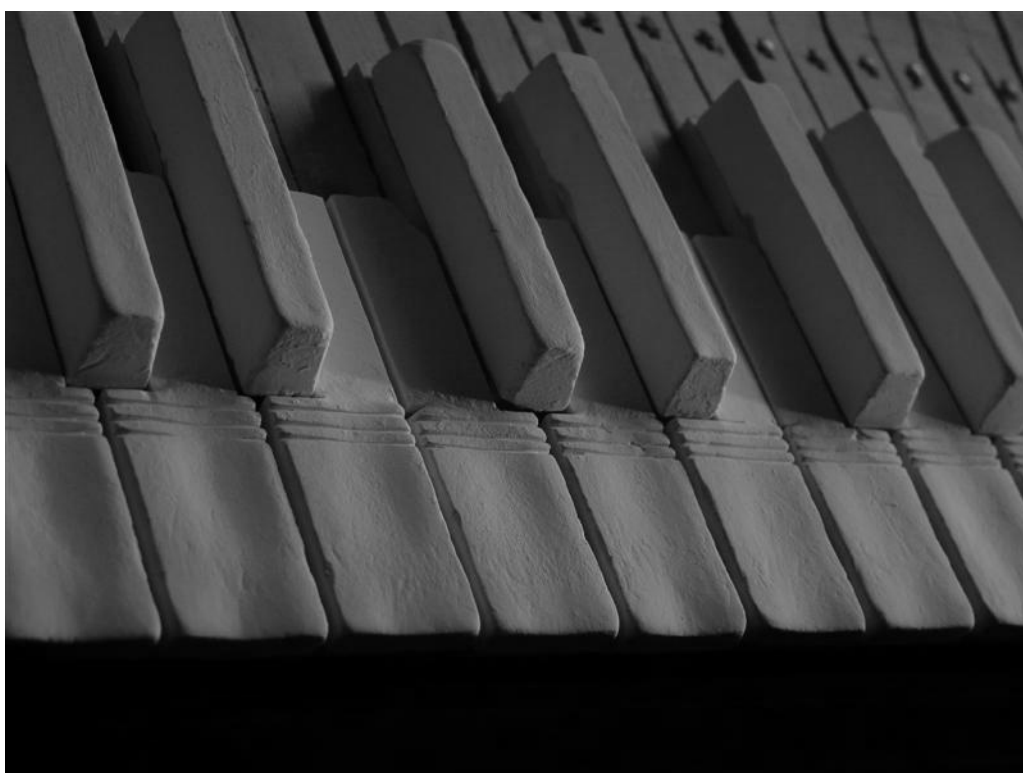
**Plate A.5.7** Wear trace after the C minor Invention, *C-H*



**Plate A.5.8** Wear trace after the C minor Invention, *F-f*



**Plate A.5.9** Wear trace after the C minor Invention, *d-h*



**Plate A.5.10** Wear trace after the C minor Invention, *a-f'*

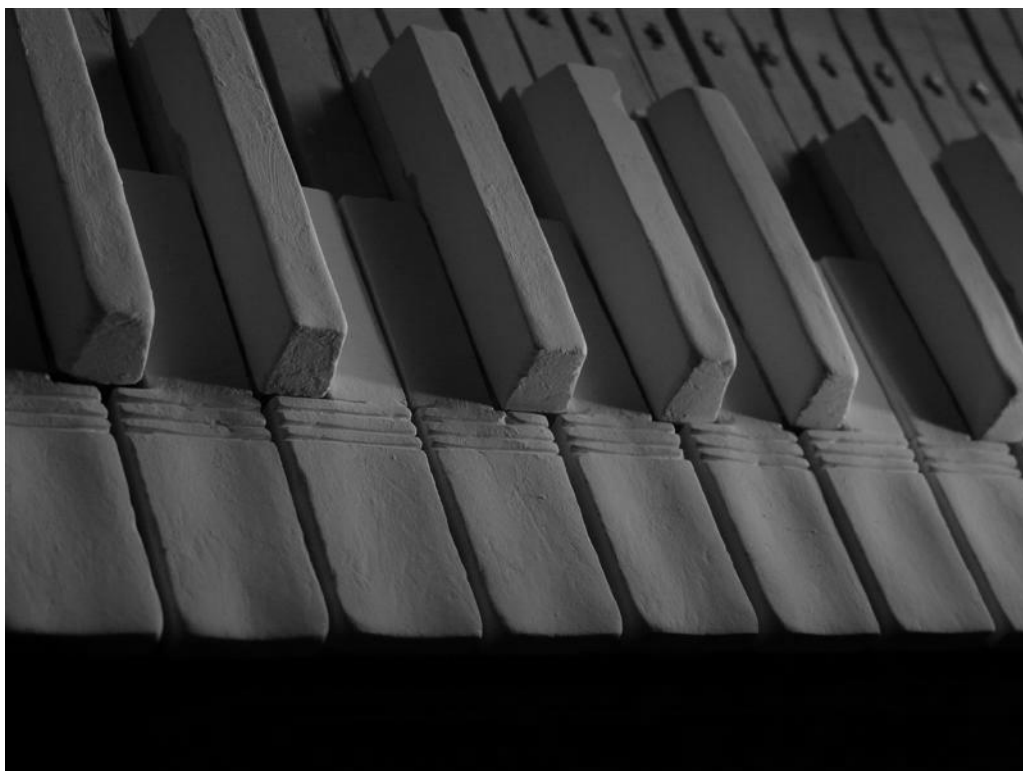


Plate A.5.11 Wear trace after the C minor Invention,  $d'-h'$

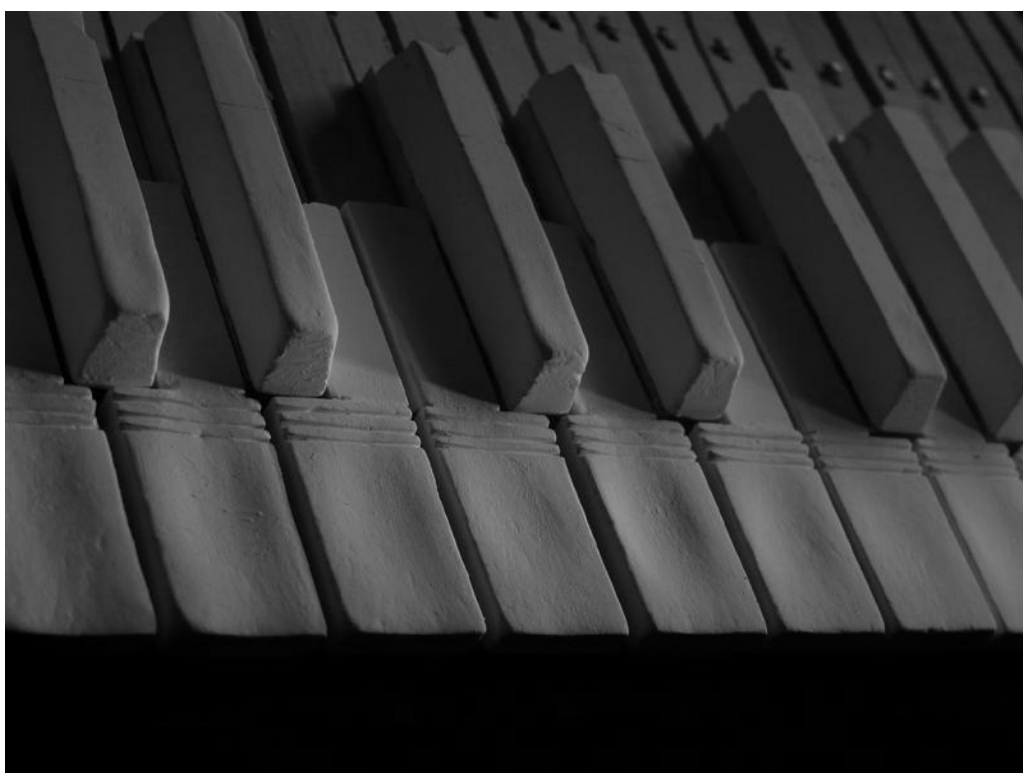


Plate A.5.12 Wear trace after the C minor Invention,  $a'-f''$

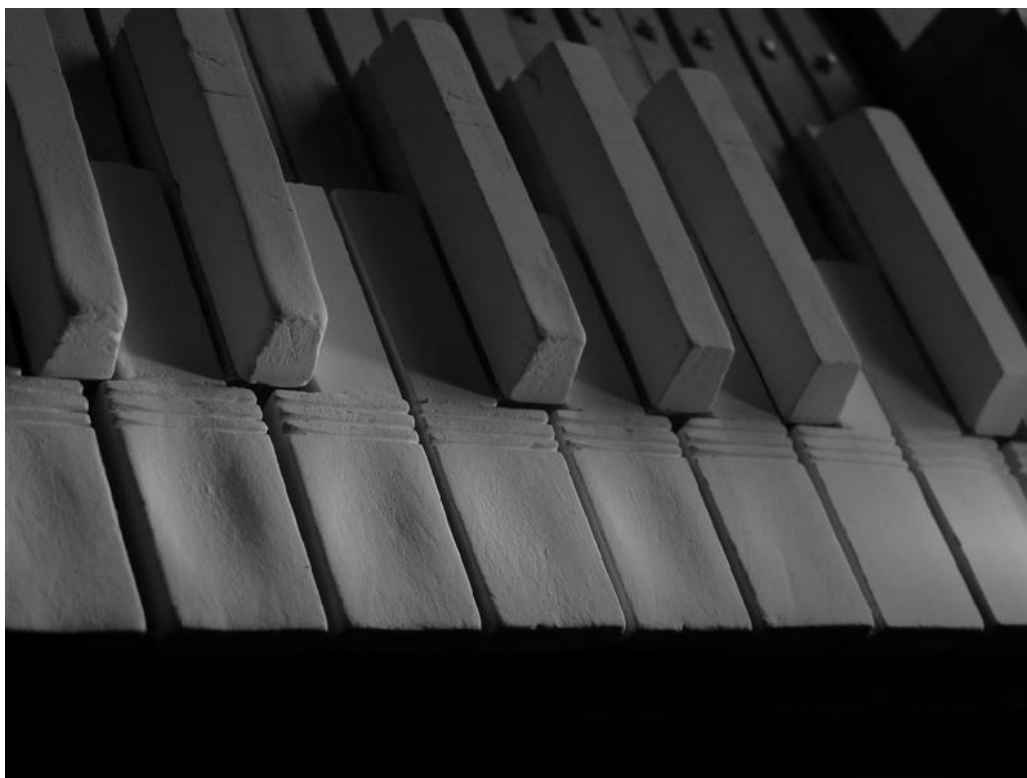


Plate A.5.13 Wear trace after the C minor Invention, *d''-h''*

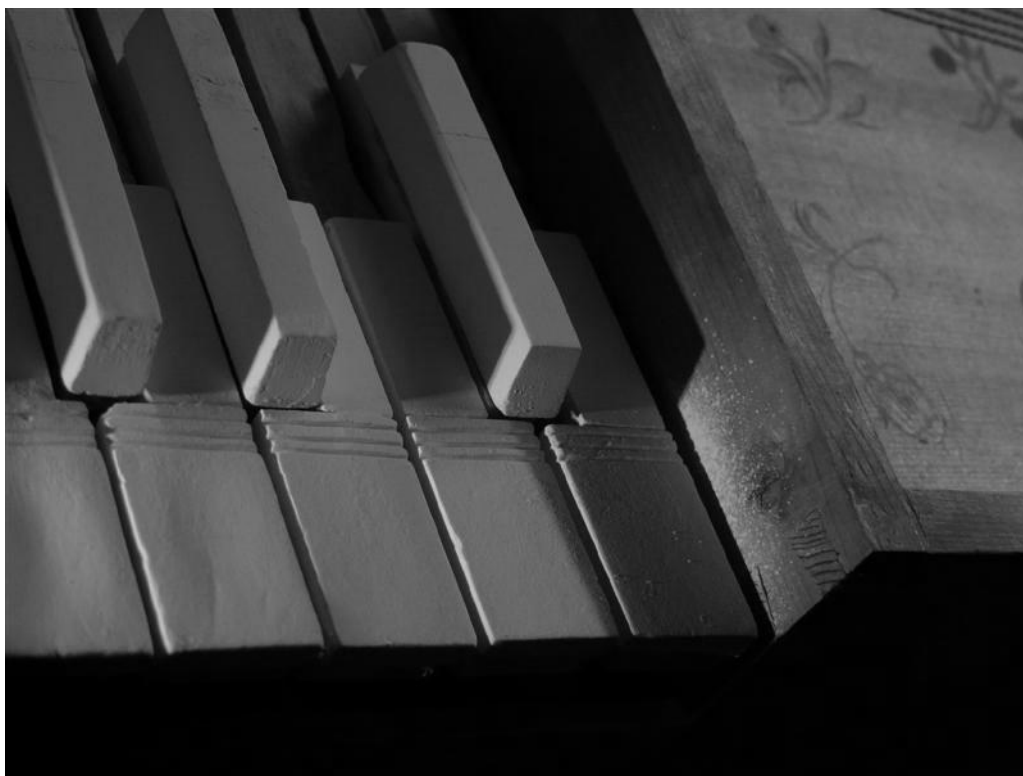


Plate A.5.14 Wear trace after the C minor Invention, *a''-d'''*

**Table of playing times on the experimental clavichord**

This table contains information regarding the amount of playing time needed, and repertoire played, for the trace of wear to be produced. Dates in the experimental-clavichord plates in chapter 5 and in this appendix correspond to those contained in this table.

Table A.5.1 Repertoire played on the experimental clavichord and playing times

Invention	Date of playing (October 2011)	Amount of time played Right hand (2x): (0'00'')	Amount of time played Left hand (2x): (0'00'')	Amount of time played Both hands (2x): (0'00'')	Observations
<b>C major</b>	14/17	4'00''/3'05''	3'45''/3'10''	4'00''/3'35''	On 14/10 a preliminary test was realised. The piece was played once with each hand and once with both hands together. Total time: 8'50''
<b>D minor</b>	17	3'15/3'35''	3'00''/3'50	4'05''/3'40''	
<b>E minor</b>	17	4'00''/3'35''	3'55''/3'05''	4'00''/3'45''	
<b>F major</b>	17	2'30''/2'20''	2'30''/2'15''	2'40''/2'25''	
<b>G major</b>	17–18	(17/10)  3'10''/2'30''	(17/10)  3'00''/2'20''	(18/10)  3'00''/2'50''	
<b>A minor</b>	18	3'25''/2'55''	3'05''/2'45''	4'00''/3'05''	
<b>B minor</b>	18	2'30''/2'20''	2'30''/2'25''	2'50''/2'40''	
<b>B flat major</b>	18–19	(18/10)  2'30''/2'30''	(18/10)  2'35''/(19/10) 2'20	3'05''/3'00''	
<b>A major</b>	20	3'05''/2'50''	3'10''/2'45''	3'50''/4'00''	
<b>G minor</b>	20	3'00''/2'25''	2'40''/2'20''	3'15''/3'30''	

<b>Invention</b>	<b>Date of playing (October 2011)</b>	<b>Amount of time played Right hand (2x): (0'00'')</b>	<b>Amount of time played Left hand (2x): (0'00'')</b>	<b>Amount of time played Both hands (2x): (0'00'')</b>	<b>Observations</b>
<b>F minor</b>	20	3'00''/2'45''	2'50''/2'45''	4'20''/3'50''	
<b>E Major</b>	22	7'50''	7'50''	6'50''/6'00''  (each observed written-out repetition)	Right and left hand playing included written-out repetition.
<b>E flat major</b>	22	3'00''/2'50''	2'50''/2'45''	3'50''/3'30''	
<b>D major</b>	22	2'55''/2'25''	2'45''/3'05''	2'30''/2'50''	
<b>C minor</b>	22/24	(22/10)  2'50''  (24/10)  3'50''	(22/10)  2'35''  (24/10)  3'15''	(24/10)  4'10''/4'05''	

Total playing times:

Right hand: 91'00''

Left hand: 88'05''

Both hands: 109'10''

Total time (+8'50'' initial playing): 297'05'' (4:57'05'')

### Table of played notes in relation to used keys

Below follows a table in which the notes used in each of the Inventions are indicated. The information contained in this table does not refer to specific pitches but merely to the presence of the note within the piece. Therefore, the fact that a ● appears on the box of all *d*'s means that this note was present in all the Inventions (either as *D*, *d*, *d'*, *d''*, or all of them).

Enharmonic notes receive a separate box. In one case (F minor Invention) the same key is used to play a flat and a sharp note within the same piece.

The symbol + indicates that the key corresponding to a note was used to play another diatonic note (e.g. E major Invention, a *d* key was used to play a *cx*).



Tonum	Praeambulum (Aufrichtige Anleitung)	Inventio	c	c#	db	d	d#	eb	e	e#	f	f#	gb	g	g#	ab	a	a#	bb	h	h#
Primum D minor	2	4		•				•				•			•				•		
			•			•			•		•			•			•			•	
Secundum G minor	10	11		•				•				•				•			•		
			•			•			•		•			•			•			•	
Tertium A minor	6	13		•			•					•			•				•		
			•			•			•		•			•			•			•	
Quartum E minor	3	7		•			•					•						•			
			•			•			•					•			•			•	

Table A.5.2 Played notes in relation to used keys (pp. 301–304)

Tonum	Praeambulum (AA)	Inventio	c	c#	db	d	d#	eb	e	e#	f	f#	gb	g	g#	ab	a	a#	bb	h	h#
Quintum C major	1	1		•								•			•				•		
			•			•			•		•			•			•			•	
Sextum F major	4	8		•				•				•							•		
			•			•			•		•			•			•			•	
Septimum D major	14	3		•			•					•			•			•			
			•			•			•					•			•			•	
Octavum G major	5	10		•								•									
			•			•			•		•			•			•			•	

Tonum	Praeambulum (AA)	Inventio	c	c#	db	d	d#	eb	e	e#	f	f#	gb	g	g#	ab	a	a#	bb	h	h#
9 C minor	15	2						•				•				•			•		
			•			•			•		•			•			•			•	
10 F minor	11	9			•			•				•	•			•			•		
			•			•			•		•			•			•			•	
11 B major	8	14						•				•				•			•		
			•			•			•		•			•			•			•	

Tonum	Praeambulum (AA)	Inventio	c	c#	db	d	d#	eb	e	e#	f	f#	gb	g	g#	ab	a	a#	bb	h	h#
12 D sharp major	13 (E flat major)	5			•			•								•			•		
			•			•			•		•			•			•			•	
13 A major	9	12		•			•			•		•			•			•			•
			+			•			•		+			•			•			•	
14 E major	12	6		•			•			•		•			•			•			•
			+			• + (cx)			•		+			+			•			•	
15 B moll	7	15	•	•			•			•		•			•			•			
			•			•			•		+			•			•			•	

# Appendix 6: Some observations on the key-tops abrasion process

If the wear evidence available from the experimental clavichord is to be used for the purposes of research one has to bear in mind that the abrasion process of the plaster top is atypical. This is as a result of a number of characteristics of the material from which the experimental tops are made. Its softness, in particular, makes its surface very vulnerable to the action of the finger. Material can thus be removed very quickly. During normal playing conditions this situation will lead to an accumulation of plaster powder on both the surface of the finger and the key.

An accumulation of plaster residue might have affected the way in which the wear-out pattern resulting from the finger action was produced: its presence could have helped to modify the mechanical interaction between the finger and the top—the accumulated plaster powder working in a similar form to sandpaper—by helping to create an attrition process not present on regular keyboard playing.

At present, there is no experimental confirmation that could confirm the impact of this situation on the trace obtained on the experimental clavichord. However, it might be safe to suggest that the experimental trace is, for the purposes of an initial attempt to study the historical trace of wear, sufficiently close to that which might have been produced without the residue accumulation. It might thus be serviceable enough in an attempt to initially evaluate historical wear traces which could eventually lead to an identification of a number of particular mechanical approaches to the key.

In order to try to reduce the impact of accumulated plaster powder to a minimum, loose plaster was removed from the keys by blowing some air over the surface of the keys in a regular form. No brush was used in order to avoid adding any abrasive effect.

Quite possibly, a different effect of the finger action would be seen in wood tops where the material's natural grain would contribute to an increase in the grip between the finger and the top surface. This grip might be substantially modified when the top is oiled. Builders might then have purposely oiled the wood tops in order precisely to reduce the amount of grip between the top and the finger, thus allowing the fingers to slide above the top in an easier manner. Other materials such as ivory and bone wear out in a substantially different manner than wood or plaster tops. This is perhaps as a result of the crystalline structure of bone and ivory which seems to contribute to the formation of smoother worn-out surfaces.

The issues named above need to be taken into account when comparing the differences between the traces of wear found in bone, ivory, wood and plaster tops. Needless to say, in the way in which the surface of the key will wear an important role is also played by its resistance to wear, the amount of time the instrument was played, the particular repertoire played on the instrument, the proportions of the key (length of the keys, ratio of the key front : balance points : tangent), and the amount and the manner in which force is applied and released.

# Appendix 7: Documenting the wear trace on historical instruments

Observing the trace of wear on historical instruments is not always easy. Documenting it can prove even more difficult. Photographic materials and electronic devices that can create a digital image are extremely helpful. However, these resources are at times limited in their capacity to capture wear clearly (e.g. see below, appendix 8). The main issue behind this situation has to do with the light reflectivity of the material of which the key tops are made.

Depending on the light conditions it is possible to observe the wear trace by finding a suitable vision angle. Devices that can be used to document wear are more difficult to position than our eyes, something which can at times take a significant amount of time without guaranteeing the same visual experience as when observing the instrument directly. Our eyes adapt better and faster to the type of light available while digital cameras and 3-D scanners often react in completely different forms to the particular reflectivity of materials such as polished bone and ivory. This imposes a necessity to find a specific light source which could facilitate documentation through these media.

The idea of documenting the trace of wear on historical instruments initially considered the use of a laser-scanning device. This project had to be abandoned due to the technology's inability to capture images from objects presenting shiny or highly reflective, as well as very dark, surfaces. The only available solution to this problem consisted in the application of a coating product to the surface to be documented. The possibility to use this approach had to be abandoned once the nature of the components of the coating material was evaluated (these were difficult to remove without the use of water or other cleansing substances).

A solution which permitted an observation of the trace of wear with a certain degree of clarity, without disturbing the instrument's physical integrity, was to use coloured light. The approach was to prove effective also for the purposes of digital-photography documentation. The method consists in illuminating the keys' surface with light, produced by a LED hand lamp, which had previously been reflected on a fluorescent-colour screen. The soft fluorescent tone of this light, when properly directed, greatly enhances the visualisation of the worn-out surface of the keys. This source of light is movable, something which permitted to fix the camera in order to produce shots from the same angle from almost the whole compass of most of the instruments. In some cases, such as that of the experimental clavichord, the most appropriate light was that of the white led. The lamp, as in the case of the use of colour screens, had to be positioned according to the response of the camera sensors (i.e. automatic focus was always used).

The reason for the necessity to move the light's source continuously is in part related to the place in which the instrument was to be studied and photographed. In many cases, it was not possible to modify the light source of the room in which the photographs were taken. This led to necessary *in situ* readjustments. Moreover, every surface reacted in a different form to different colour filters. In other words, while a florescent-green filter had worked well on ivory keys in one instrument, it would not show the wear trace in the same detail in another. The filters used thus represent the best available solution under the light circumstances in which the photographs were taken.

### **Information on the materials used when documenting the wear trace**

One 4-white-LED lamp

Fluorescent paper

Tripod

Camera: Panasonic, DMC-FZ18; Size of the original files: 8 MB



# Appendix 8: Description of the 3-D surface's analysis: a proposed approach

The surface-profile-measurement technique is a method of imaging and quantifying three dimensional features. It might be suited for the purposes of the study of wear because of its ability to produce geometrically-accurate 3-D images and the corresponding volumetric data sets of (worn-out) surfaces. This method yields images that can be analysed with respect to surface profile (including surface roughness), surface area, and volume. However, at present the device is unable to capture images from dark or shiny surfaces. It is possible that in a near future it might become a technology which would facilitate the study of the trace of wear.

Because the worn-out key top possess a free-form surface, a robust measurement system is necessary to provide adequate resolution of the measured volume throughout the depression's entire depth. Once the depressed surface of the test key top is captured with the camera, the latter's software generates a 3-D reconstruction. Here the results of a test realized on June 2005 are presented.<sup>1</sup> The instrument chosen for this test (for the technical reasons named above) was a virginal by Domenico Pisaurensis (Venice, middle of the 16<sup>th</sup> century, Musikinstrumenten-Museum Berlin, cat. Nr. 324, Compass: *E-c''*). The keys measured were:

- a) *h'''* (slightly worn-out key);
- b) *h''* (heavily worn-out key)

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<sup>1</sup> This measurement test was realised with the kind support of Ms Sabine Hoffmann, keyboard instrument restorer at the Musikinstrumenten-Museum, Berlin, and engineer Silvio Zepke, GFMesstechnik GmbH, Berlin. GFMesstechnik GmbH, Warthestrasse 21; D-14513 Teltow/Berlin, Tel.: +49/3328/316760; Fax: +49/3328/305188, <info@gfmesstechnik.com>, <www.gfmesstechnik.com>.

The first two plates show a normal camera image of both keys.

a)

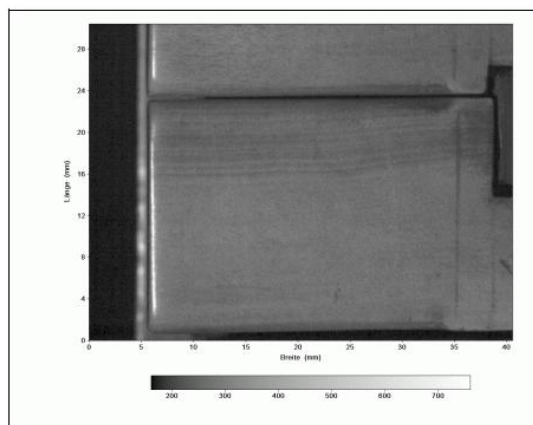


Abb. 02: Kamerabild der *leicht* verschlissenen Taste

b)

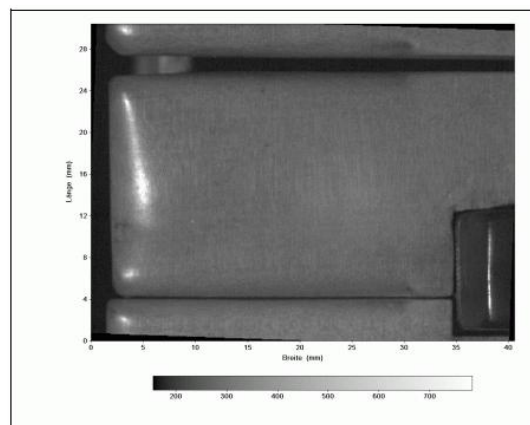


Abb. 03: Kamerabild der *stark* verschlissenen Taste

The measured keys are then reproduced in the form of colour-coded relief images.

a)

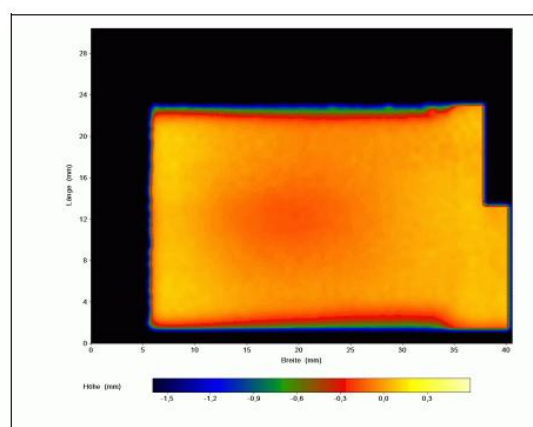


Abb. 04: farbcodiertes Höhenbild der *leicht* verschlissenen Taste

b)

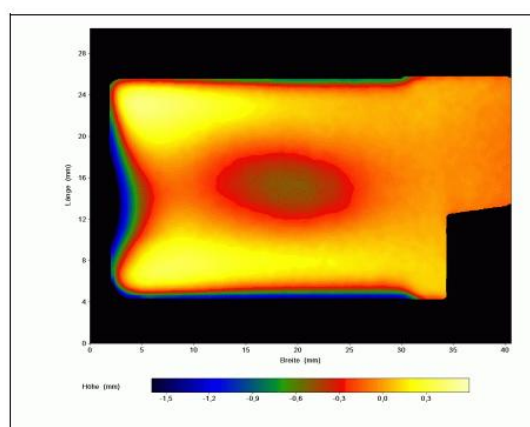


Abb. 05: farbcodiertes Höhenbild der *stark* verschlissenen Taste

After the selection of an axis, the computer's program is able to calculate a graphic which compares the resulting profiles -a) blue curve, b) black curve.

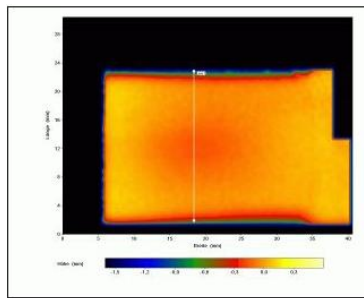


Abb. 06: farbcodiertes Höhenbild mit Schnitt Nr. 1  
(leicht verschlissenen Taste)

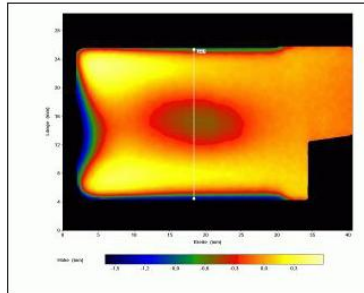


Abb. 07: farbcodiertes Höhenbild mit Schnitt Nr. 1  
(stark verschlissenen Taste)

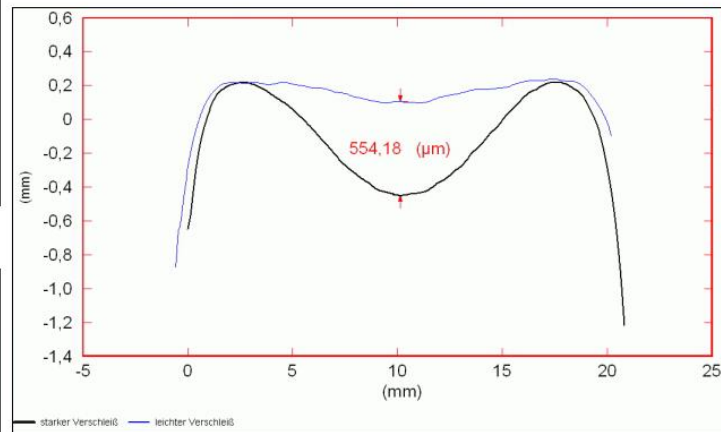


Abb. 08: Profilbild, Schnitt Nr. 1 von beiden Tasten

If the axis is placed at the front of the key, it is then possible to see a heavy worn-out section on the second key, produced by the thumb's movements.

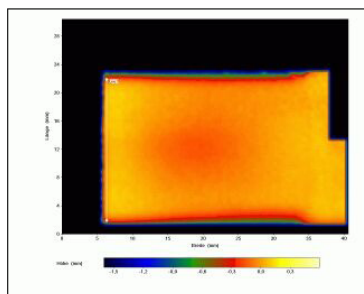


Abb. 09: farbcodiertes Höhenbild mit Schnitt Nr. 2  
(leicht verschlissenen Taste)

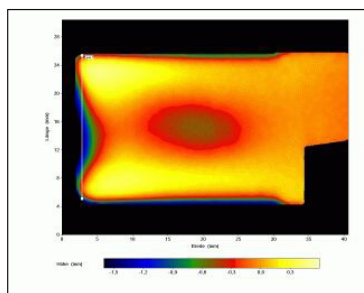


Abb. 10: farbcodiertes Höhenbild mit Schnitt Nr. 2  
(stark verschlissenen Taste)

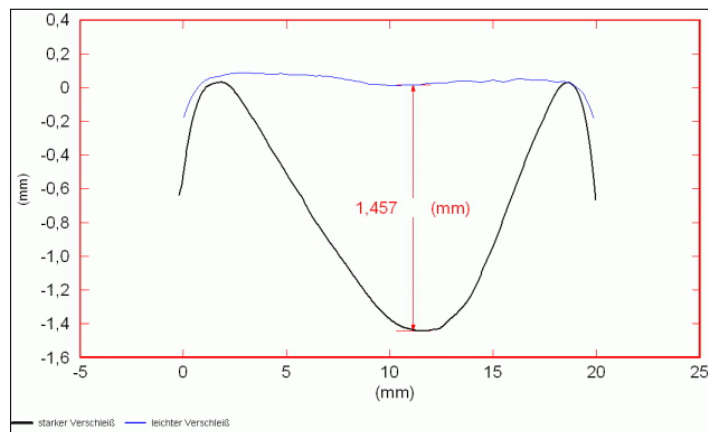


Abb. 11: Profilbild, Schnitt Nr. 2 von beiden Tasten

The last graphic shows us the comparison between the two keys placing an axis that runs along the key. It is possible to see both the depression in the middle of both keys and the worn-out section at the front of  $h'''$ .

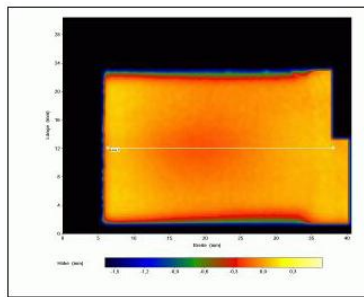


Abb. 12: farbcodiertes Höhenbild mit Schnitt Nr. 3  
(leicht verschlissenen Taste)

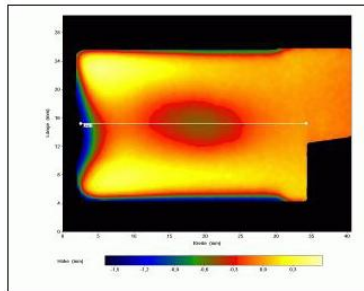


Abb. 13: farbcodiertes Höhenbild mit Schnitt Nr. 3  
(stark verschlissenen Taste)

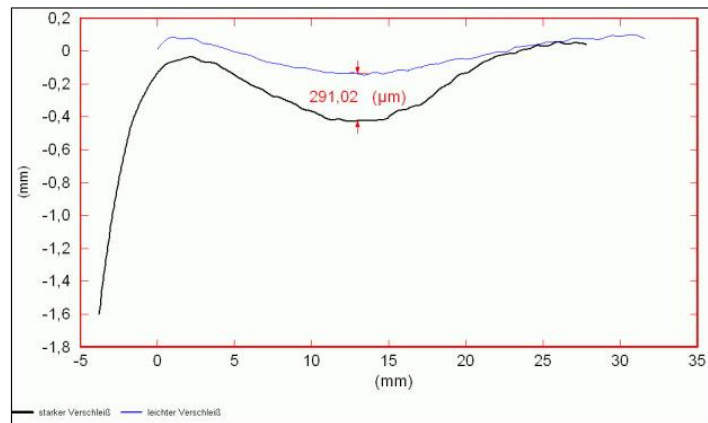


Abb. 14: Profilbild, Schnitt Nr. 3 von beiden Tasten

A final 3-D reconstruction offers a final contrast of both keys.

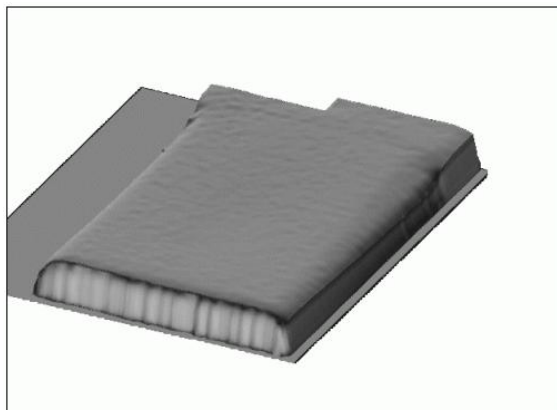


Abb. 15: photorealistische 3D Darstellung der leicht verschlissenen Taste

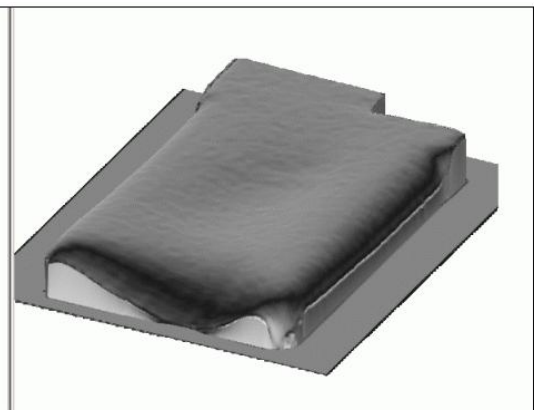


Abb. 16: photorealistische 3D Darstellung der stark verschlissenen Taste

The use of this technology would allow the comparison of hundreds of keys within a very short amount of time. The results could then provide invaluable evidence for the purposes of technique reconstruction and study of performance practices.

# Appendix 9: Instruments inspected

Below follows a list of those instruments analysed in detail for the present study.<sup>1</sup>

Although a larger number of instruments were inspected, a number of them were not considered for this study for one of the following reasons: 1) insufficient wear evidence; 2) incomplete keyboard; 3) signs of keyboard modification; 4) instruments built after 1750; 5) it was not possible to collect detailed information (as a result of the instrument being in a showcase).

## **Musikinstrumenten-Museum (Berlin), MIM**

Fretted clavichord, anonymous (Germany, c.1752), cat. no. 227

Polygonal virginal, D. Pisaurensis (Venice, 16<sup>th</sup> century), cat. no. 324

Fretted clavichord, anonymous (The Netherlands, c.1700), cat. no. 2154

Fretted clavichord, anonymous (Spain, 18<sup>th</sup> century), cat. no. 2161

## **St Cecilia's Hall Museum of Instruments (Edinburgh), STC**

Fortepiano, I.H. Ölmütz (Bohemia, 1825), cat. no. 4347

Fretted clavichord, anonymous (Flemish?, c.1620), cat. no. 4486

Unfretted clavichord, anonymous (Dresden?, c.1740), cat. no. 4487

## **Grassi Museum für Musikinstrumente der Universität Leipzig (Leipzig), GMI**

Fretted clavichord, D. Pisaurensis (Venice, 1540), cat. no. 1<sup>2</sup>

Unfretted clavichord, J.A. Hass (Hamburg, 1748), cat. no. 26

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<sup>1</sup> In 2008, the instruments in the collections named below were inspected to verify the condition of their keyboards. A second visit in 2010 served to collect detailed information and photographic materials of those instruments which were considered could help to build an understanding of the process behind the appearance of the trace of wear.

<sup>2</sup> It was not possible to document this instrument photographically. However, visual inspection helped to study its wear traces.

Single-manual harpsichord, D. Pisaurensis (Venice, 1533), cat. no. 67

Single-manual harpsichord, Antonio Migliai (?, 1702), cat. no. 82

Spinettone, attributed to B. Cristofori (Florence, c.1720), cat. no. 86

**Germanisches National Museum (Nurnberg), NGM<sup>3</sup>**

Fretted clavichord, anonymous (south Germany, end of the 17<sup>th</sup> century), MINe 60

Fretted clavichord, anonymous (Germany, end of the 17<sup>th</sup> century), MIR 1048

Unfretted clavichord, H. Silbermann (Straßburg, 1775), MIR 1061

Polygonal virginal, Domenico Pisaurensis (Venice, 1540), MIR 1081

**The Nydahl Collection, Stiftelsen Musikkulturens Främjande (Stockholm), SMF**

Fretted clavichord, J.C. Fleischer (Hamburg, 1722), IKL046

Unfretted clavichord, H.A. Hass (Hamburg, 1744), IKL048

Polygonal virginal, attributed to G. A. Baffo (Venice, 1540), IKL056

Single-manual harpsichord, attributed to D. Pisaurensis, IKL057

**Musik/Teater Museet (Stockholm), MTM**

Unfretted clavichord, Philip Jakob Specken, (Stockholm, 1743), M2625<sup>4</sup>

Fretted clavichord, anonymous (probably Swedish, c.1700), N264785

**National Historical Museum, Stockholm**

Norrlanda organ

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<sup>3</sup> All the clavichords in this collection were examined. During the 2008 and 2010 inspections it was not possible to locate the fretted clavichord MIR 1046.

<sup>4</sup> This instrument shows on the surface of the natural key plate a trace of wear, in the form of a long groove, which is similar to that visible in J.C. Fleischer (Hamburg, 1722), IKL046, plate 5.55; and H.A. Hass (Hamburg, 1744), IKL048, plate 5.59.

Fragment of a Swedish organ board (Anga Church (Gotland), 13<sup>th</sup> (?) century), cat.  
no. 13068

**Royal College of Music, London**

Clavicytherium, anonymous (south Germany?, c.1480), RCM 1

Regal, anonymous (German?, Early 17<sup>th</sup> century), RCM 209

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